INTERPRETATION OF DENTAL AND MAXILLARY ROENTGENOGRAMS

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BY

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MATTHEW H. CRYER, M.D., D.D.S.

PREFACE TO THE SECOND EDITION

In the second edition it has not been considered necessary to make material changes in the main text. A large number of new illustrations with their descriptive captions have been added, the authors drawing largely upon the material presented in the clinics of the Thomas W. Evans Institute.

R. H. I.
L. M. E.

Philadelphia, Pa.

PREFACE TO FIRST EDITION

The purpose of this small volume is to present to members of the medical and dental professions the data necessary for making an intelligent diagnosis of pathologic conditions about the teeth and jaw bones in which roentgen examination plays a part. It is hoped that a basis for this will be formed by study and comparison of the numerous normal and abnormal views shown.

It has been said that the actual making of the roentgenogram is the elementary feature of roentgenology, and that those who know how to interpret roentgenograms are few in number compared with those who know how to make them. It is to interpretation rather than to technic that the writer has endeavored to call particular attention in the following pages, references to technic being limited to special points involved in examination of the teeth and jaw bones.

A departure from the usual method of presentation lies in the fact that in this work the roentgenograms are negative reproductions; i. e., they correspond with the

original negatives in that bone and hard tissues are light, and soft tissues and spaces are dark, instead of being merely prints of the negatives, in which the dark and light portions are reversed; so that in studying these illustrations there is a near approach to natural conditions found in the original negatives.

In a majority of the odontograms showing periapical pathology, the writer has been in a position to compare the pictures with the conditions found at operation, so that in these cases the interpretations are not based merely upon surmise.

The writer desires to thank Dr. M. H. Cryer for permission to use the excellent anatomic illustrations taken from his *Internal Anatomy of the Face*, and also his associates, Drs. P. B. Wright and M. H. Mortonson, for cooperation and help in the preparation of roentgenograms.

Acknowledgment is also due the publishers for their patience in waiting for the manuscript, which was considerably delayed owing to the exigencies of military service.

Robert H. Ivy.

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PART I

CHAPTER I

GENERAL CONSIDERATIONS

The application of the roentgen ray as a means of diagnosis of pathologic conditions about the teeth and jaws is a method that has achieved a position of the utmost importance in recent years. Its value has long been recognized by the surgeon in the diagnosis of the grosser surgical lesions of the maxillary bones, such as fractures, tumors, impacted teeth, etc. Until recently, however, the dentist in general practice rarely found it necessary to resort to investigation by means of the x-ray. At the present time, to those who are familiar with its advantages, the daily employment of this agent as a means of diagnosis and as an aid to proper treatment has become indispensable.

It is not my purpose here to deal with the knowledge necessary for the making of roentgenograms, involving as this does a study of electricity, theory of production of x-rays, a description of x-ray machines and tubes, etc. What is of far more importance to the average dental or medical practitioner is to know how to interpret roentgenograms after they are made. Mistakes are frequently made by those having an inadequate knowledge of the primary essentials which will presently be discussed.

At this point an explanation of certain terms to be used in the book is in order. In speaking of x-ray pictures many different terms are employed, such as roentgenogram, skiagraph, skiagram, radiograph, etc. The American Roentgen Ray Society, which may be properly taken as the official representative of this branch of medical science in the United States, has adopted in honor of Roentgen, the discoverer, a nomenclature which I consider it advisable to follow. Thus, in speaking of an x-ray picture the term "roentgenogram" is to be preferred. "Roentgenology" is preferable to "radiology." Certain other words have been coined for the sake of brevity, such as "stereogram," meaning a stereoscopic roentgenogram; "pyelogram," a roentgenogram of the pelvis of the kidney after injection with some salt that resists passage of the rays. In the same way the term "odontogram" is here suggested for a roentgenogram depicting the teeth.

Since the general recognition of the important relationship of infections of the investing tissues of the teeth to various pathologic conditions of the body, an examination for the detection of the cause or portal of entry of many generalized infections may be justly regarded as incomplete without a thorough investigation of the teeth and surrounding parts. Since serious periapical dental infection may be present in the entire absence of subjective or objective symptoms or history of trouble, every examination of this type should include a roentgenographic study of all crowned and pulpless teeth, and parts of the alveolar process from which teeth are apparently missing. The necessary cooperation between physician and dentist in eliminating possible foci of infection within the mouth can only be achieved through an ability on the part of each to intelligently interpret roentgen ray findings. The lack of dental knowledge on the part of the physician usually leads to unnecessary sacrifice of teeth, while the dentist's igno-

rance of proper roentgen ray interpretation often means ultraconservatism with consequent danger to the health of the patient. The importance of thorough study of this subject is manifested by the occurrence of cases which baffle even those of great experience in all phases of dental diagnosis, including the roentgen ray.

There is no intention here to intimate that every dentist should be equipped with an x-ray outfit and make his own roentgenograms. Most men have not the time to devote in which they can acquire a mastery of the subject. In the average individual practice there is not sufficient variety to give one experience in interpretation. At the same time, dentistry can not be intelligently or conscientiously practiced without convenient access to this method of diagnosis at least in all cases where root canal operations are involved. Where the dentist himself does not make the roentgenogram, the burden of interpretation should not fall entirely upon the roentgenologist, who is usually without knowledge of the clinical conditions of the individual case or of dental pathology in general. Unless he has had experience in this work the dentist should not attempt to read the roentgenogram without help, even though he be entirely familiar with the clinical aspects of the case.

In the following pages it is endeavored to point out the essentials necessary for correctly diagnosing pathologic conditions about the teeth with the roentgen ray as an aid. That the roentgen ray is merely an aid in arriving at this diagnosis can not be too strongly emphasized, and, therefore, a proper interpretation of a roentgenogram can, as a rule, only be given after one has gained a knowledge of certain general facts, as well as special data pertaining to individual cases in question.

The *general* knowledge necessary for the correct interpretation of odontograms comprises the following:

1. The normal anatomy and histology of the teeth and jaw bones, together with anatomic variations.

2. The appearance that the roentgen ray should impart to plates and films after passage through such normal tissues and anatomic variations.

3. Special dental pathology both from the clinical side and the histopathologic side.

After mastering these three essentials, one is in a position to take up—

4. The various abnormalities produced in the roentgenogram by disease.

The four points mentioned will be discussed more in detail in subsequent chapters. After acquiring a thorough familiarity with them, it is hoped that the student will be in a position, with the aid of the special clinical facts pertaining to the individual case, to make use of the valuable assistance afforded by roentgenographic examination.

Limitations of Roentgenography

The longer one is engaged in this work, the more conservative and less positive he becomes in giving an opinion as to what is represented in a given plate or film. He begins to see the error and folly of calling every dark spot at the end of a tooth root an "abscess," which in reality is found less commonly than some other abnormal conditions. Like everything new, the roentgen examination of the teeth has been overworked, and very extravagant claims have been made. Based upon roentgenologic interpretation by workers ignorant of dental conditions, or of the clinical facts in individual cases, physicians have ordered the wholesale extraction of absolutely healthy teeth. The failure to obtain improvement of systemic complications in such cases, in which the teeth never had any bearing on the question at all, has produced a reaction on the part of some men, who question the value of dental roentgen diagnosis entirely, an opinion that is hailed with joy by some nonprogressive or ultraconserva-

tive dentists who dislike anything that is likely to force a change in their obsolete methods of practice.

The time has come, however, when those working in this field are in a position to state with some assurance how far the roentgen ray may be relied upon. We must start out with the general proposition that what we see in a roentgenogram is only a varied gradation of shadow cast by the rays passing through substances of different density. Speaking strictly, therefore, we can only say in regard to dark areas on the negative that they represent places of lessened density, which allow the rays to pass through more easily than the surrounding parts. This is as far as a person untrained in the fundamental principles mentioned is justified in giving an opinion. What the actual contents of the rarefied areas are, we can seldom say definitely from the roentgenogram alone, although along with the clinical findings and history we can often predict with some assurance as to what will be found at operation. Even in the absence of symptoms, a periapical rarefied area as shown in the odontogram does mean usually that disease of some kind is present, unless the picture has been made shortly after operation before the area has had time to become obliterated. The statement has been frequently made by some eminent authorities that these areas of rarefaction shown by the roentgen ray are noninfective in the absence of pain and local symptoms, and may simply represent the results of previously existing disease that has been cured, in other words, that they contain harmless scar tissue. While conceding this possibility in a small number of cases, I believe that the persistence of such a rarefied area for any length of time without signs of decreasing in size is sufficient evidence that a disease process is going on, otherwise the area would gradually become smaller and be replaced by new bone. There is abundant postoperative x-ray evidence that these areas of rarefaction disap-

pear and are replaced by new bone unless infection remains. Operative and postoperative pathologic findings so strongly support the view that these rarefied areas as shown by the roentgen ray are active foci of disease in most cases, that in our opinion it is the wisest course to regard them as diseased until proved healthy, especially in invalids, as it is a much more serious matter to leave a potential source of systemic infection than to eradicate a possibly healthy area.

We sometimes hear the following statement made by the unduly conservative skeptic after he has extracted or has had extracted teeth shown by the roentgen ray to be responsible for periapical bone destruction: "I examined the teeth carefully after they were out, and there was nothing wrong with them." In other words, he attempts to convey the impression that owing to mistaken roentgen diagnosis the teeth were unnecessarily sacrificed, basing his opinion on a casual superficial inspection of the teeth alone, when the real seat of the disease was located, not in the tooth itself, but in the surrounding alveolar process. A postoperative opinion, to be of any value, should be based on what is found by proper curettement of the rarefied bone about the apices of the extracted teeth, including perhaps bacteriologic and histologic study of the tissue removed. Because there is no visible absorption or exostosis of the root, no fluid pus, or no so-called "abscess sac" adherent to the root when it is extracted, this does not necessarily mean that no disease is present in the surrounding bone.

While we can never say absolutely from the odontogram what constitutes the contents of these rarefied periapical bone areas, yet a study of the picture often reveals points that enable us to make at least a tentative diagnosis. Thus, a round or oval area of bone rarefaction with very sharply defined regular edges, and which permits practically complete passage of the rays, is fairly

good evidence that a cyst is present. On the other hand, an area with ill-defined edges, merging almost imperceptibly with the surrounding healthy bone, and in most of its parts offering at least some resistance of the passage of the rays, is indicative of the presence of a more or less active suppurative process. Between these two extremes we find various gradations, among which may be placed cases of granuloma. The size of an area of suspected abnormality has no relation to its character or pathogenicity. Disease may be present without pus. Absence of an abnormal roentgenographic area does not necessarily mean that the tissue must be healthy. A tooth may contain infected necrotic pulp tissue, giving rise to systemic involvement, yet show no evidence of bone rarefaction in the odontogram. A sinus discharging pus may be present, yet there may be insufficient periapical bone rarefaction or destruction to be demonstrable by the roentgen ray. We frequently find at operation conditions much worse than depicted in the odontogram, so that the latter often underestimates and seldom exaggerates the amount of disease present.

Localization

Roentgenograms as ordinarily made do not give any perspective, and it is generally impossible in such pictures to determine the relative positions of given parts of the objects shown except in two dimensions. We have two means of gaining a better idea of the relative positions of objects hidden from view by the tissues, such as roots of teeth, etc. The simplest is by making two or more odontograms in different positions, and comparing the different pictures. The other method is by stereoroentgenography; i. e., making two views with the plate or film and the object in the same relative positions, but with the rays at different angles, perspective being gained by merging the two images in the stereoscope. These two methods will be described in another chapter.

CHAPTER II

ANATOMY OF THE TEETH AND JAWS, WITH SPECIAL REFERENCE TO ROENTGENOGRAM INTERPRETATION

In the passage of the roentgen rays through the tissues, the denser the tissue the greater the obstruction offered to the rays, and consequently the lighter will be the image in the negative.

In roentgenograms of the jaws, the substances depicted in the order of their density, beginning with the densest, and therefore the lightest in the negative, are:

1. Metallic crowns and fillings, and root canal fillings containing zinc or other metals.
2. Enamel of the teeth.
3. Dentine.
4. Cementum.
5. Cortical bone.
6. Cancellated bone.
7. Medullary spaces, canals, foramina in bone, and soft tissues.

In disease, the normal condition of a given tissue may be changed either to a lessening in density, meaning abstraction of lime salts, with consequent deepening of the shadow in the x-ray negative, or an increase in density, due to a deposit of lime salts, and indicated by a lessening of the shadow.

A familiarity with the anatomy of the teeth and jaw bones is one of the fundamental essentials for correct interpretation of odontograms. Lack of this knowledge is frequently a cause of mistaking of normal shadows for manifestations of disease.

The teeth are set in sockets in the alveolar process, being attached by the peridental membrane. The alveolar process is composed of spongy or cancellated bone (Fig. 1), which appears in the roentgenogram as a fine interlacing network. The sockets of the teeth are lined with a thin plate of dense bone, which is shown in the x-ray

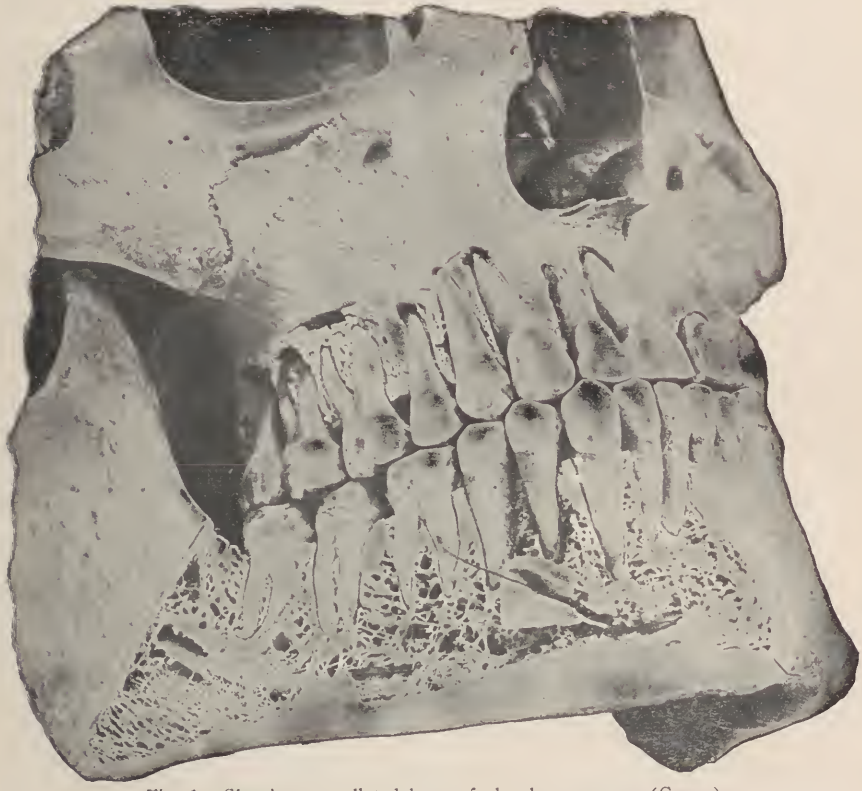


Fig. 1.—Showing cancellated bone of alveolar process. (Cryer.)

negative as a fine white line around the tooth. Between this line and the tooth itself is a narrow dark space representing the peridental membrane. *These lines are important landmarks in the interpretation of odontograms, as their absence or deviation usually means some pathologic condition.* (See Fig. 41, p. 80.)

Roentgenographic Anatomic Landmarks in the Upper and Lower Jaws

Upper Jaw

At a varying distance above the apices of the central and lateral incisor teeth is found the *floor of the nose* (Fig. 2), sometimes seen in the odontogram as a dark

Fig. 2.—Anterior view of skull, showing anterior opening of nasal chamber. (Cryer.)

shadow which might be mistaken for a cystic or abscess cavity in the bone (Figs. 49 and 50, p. 82).

Above the apices of the premolar and molar teeth is found the maxillary sinus or antrum of Highmore. This sinus varies very much in its extent, shape, and in the relation of its floor to the roots of the teeth. Sometimes there is a considerable thickness of bone between the tooth apices and the sinus (Fig. 3). In other cases the tooth

apices come right up to the floor of the sinus, even forming projections into the cavity, though under normal conditions always separated from it by a thin lamina of bone (Fig. 4). Sometimes the ends of the roots are found well

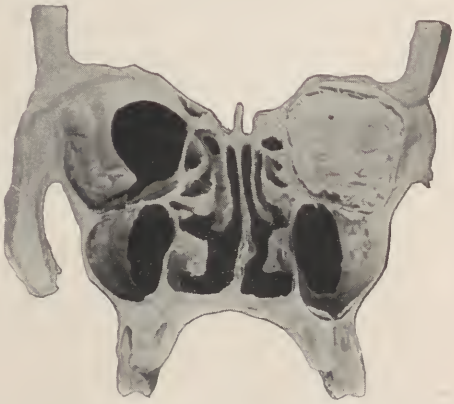


Fig. 3.—Showing considerable thickness of bone between the apices of the molar roots and the maxillary sinuses. (Cryer.)

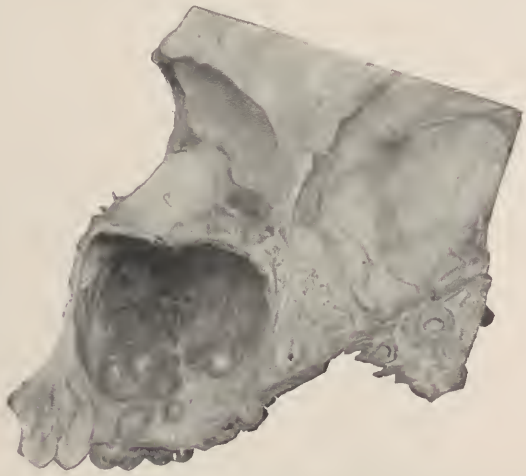


Fig. 4.—Showing smooth prominences in floor of maxillary sinus overlying apices of roots of premolar and molar teeth. (Cryer.)

above the most dependent portion of the sinus, but located in its wall (Fig. 5). The floor of the maxillary sinus is usually found in relation to the roots of the molar

Fig. 5.—Showing floor of maxillary sinus dipping down between roots of molar tooth, the apices thus being above the level of the floor. (Cryer.)

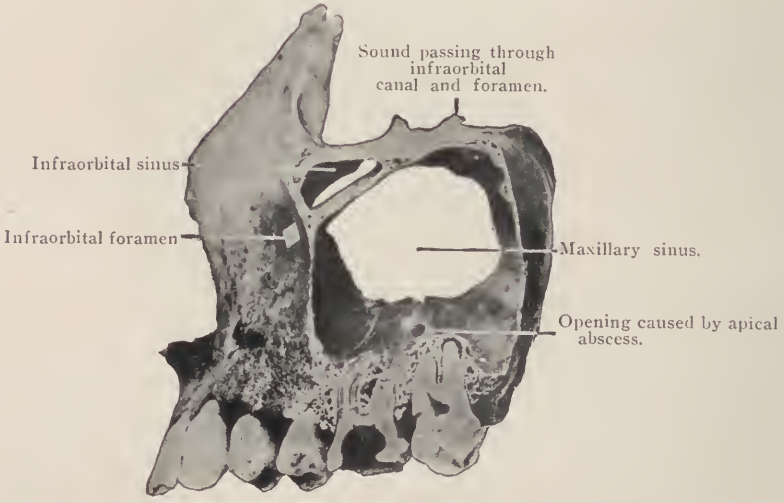


Fig. 6.—In this specimen the maxillary sinus does not extend much anterior to the first molar. (Cryer.)

teeth (Fig. 6), but may extend as far forward as the first premolar or canine (Fig. 7). These varying relations of the floor of the antrum of Highmore to the roots of the teeth are well shown in x-ray negatives, the cavity of the antrum appearing as a dark shadow which must

Fig. 7.—Here the floor of the maxillary sinus extends in front as far as the region of the first premolar tooth. (Cryer.)

not be mistaken for a rarefied disease area. It is sometimes difficult in the study of odontograms of this region to determine whether or not the roots of the teeth project into the maxillary sinus and whether areas of absorption about the roots communicate with it. In the odontogram,

where a root is projected above the level of the floor of the antrum, it is important to seek carefully the dark and light lines found around normal teeth in order to differentiate the normal condition shown in Figs. 5, and 104, p. 96, from pathologic conditions in which roots communicate with the cavity of the sinus.

Foramina, Canals, Etc.—In the upper jaw, on the

Fig. 8.—Showing anterior palatine fossa just behind and between the upper central incisor teeth. The posterior palatine canal is seen as a groove running parallel to and just within the line of the molar teeth. (Cryer.)

palatal surface just behind and between the central incisor teeth is found the *anterior palatine fossa* (Fig. 8). This contains foramina carrying blood vessels and nerves from the nose. In roentgenographic films of the anterior teeth this fossa is frequently seen as a dark shadow above and between the apices of the central incisors, and when

in close relation to roots of teeth under suspicion, might be mistaken for rarefaction due to disease of the bone (Fig. 43, p. 80).

The *posterior palatine canal* (Fig. 8), is found in the form of a groove running posteroanteriorly in the roof of the mouth mesially to the molar teeth. In the roentgenographic film it is occasionally shown as a dark

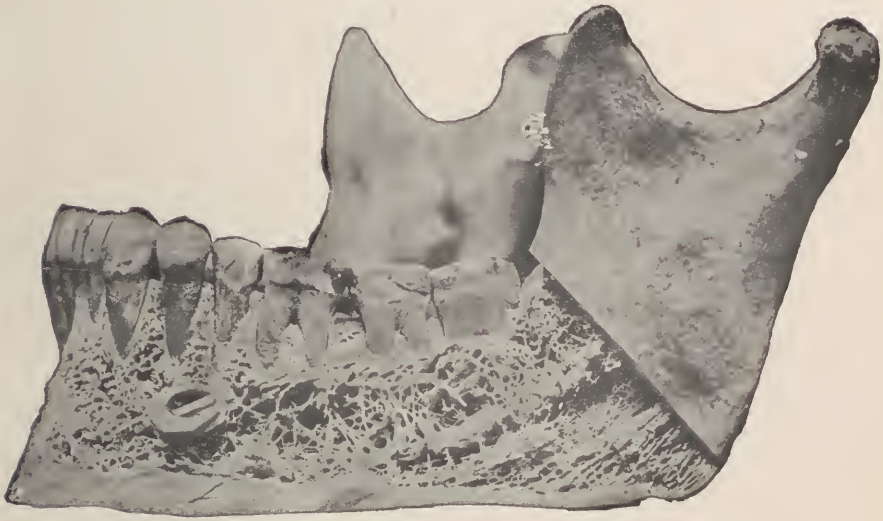


Fig. 9.—Showing cancellated internal structure of mandible with mental foramen below and between roots of premolar teeth. (Cryer.)

shadow in the wall of the antrum in close relation to the palatal roots of the molar teeth.

Lower Jaw

Here the principal roentgenographic anatomic landmarks are the *mandibular canal* and the *mental foramen* (Fig. 9). The *mandibular canal* runs posteroanteriorly below the apices of the teeth, and sometimes in very close relationship with them. (Fig. 10.) In the roentgenogram the root of a lower molar may apparently project into the dark space representing the canal, yet in reality be situated to one side or the other.

The *mental foramen,* situated below and between the lower premolar teeth, may easily be mistaken for an area of disease associated with one of these teeth, par-

Fig. 10.—Plate of right side of face, with head placed especially to show molar region. Horizontal impaction of lower third molar. (See Fig. 11.) Mandibular canal seen below this tooth.

ticularly if there are clinical signs giving a suspicion of trouble (Fig. 199, p. 121). Very frequently, however, the connection of the mental foramen with the inferior dental canal can easily be seen in the roentgenogram (Fig. 203, p. 122).

In films of the upper premolar and molar region the

overhanging malar bone frequently casts a shadow which obscures the roots of these teeth (Fig. 141, p. 105).

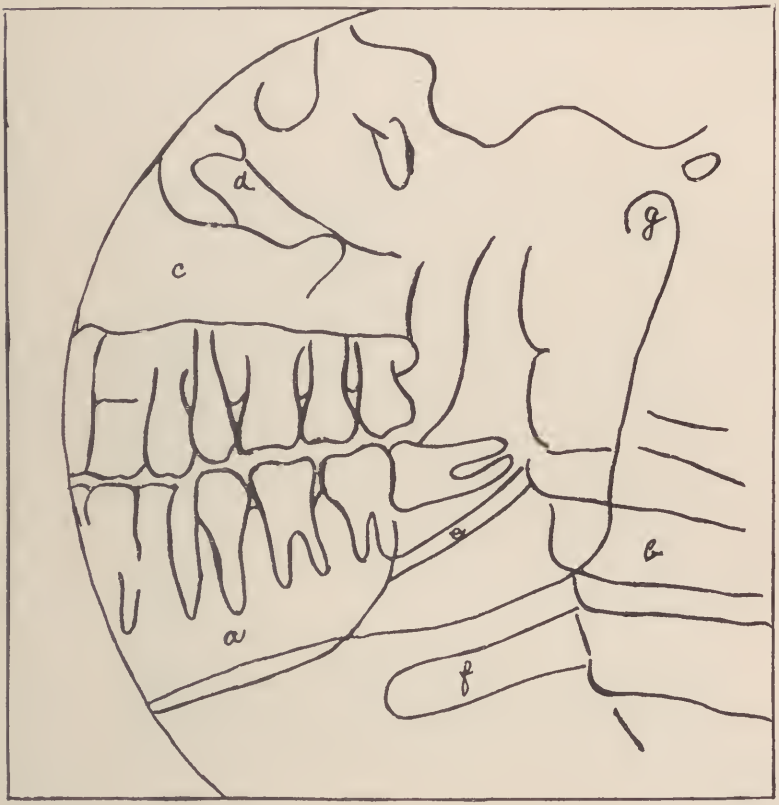


Fig. 11.—Diagrammatic illustration of Fig. 10. *a*, Portion of lower jaw overlapped by shadow of opposite side; *b*, vertebræ; *c*, maxillary sinus and nasal fossa; *d*, region of ethmoid cells; *c*, mandibular canal; *f*, hyoid bone; *g*, condyle of mandible.

Anatomic Landmarks in Roentgenographic Plates of the Jaws

In a lateral roentgenographic *plate* of the upper and lower jaws, made with the head in the position shown in Fig. 24, attention is called to certain anatomic landmarks, which are shown in Figs. 10 and 12, and diagrammat-

ically in Figs. 11 and 13. The upper and lower teeth of the side examined are usually well shown from the third molars forward to the canines. In the anterior portion of such a plate, the shadow of the opposite side of the jaws overlies that of the side nearest the plate, the amount of overlapping depending on whether the patient's nose is pressed down on the plate or slightly

Fig. 12.—Plate of left side of face, showing normal anatomic landmarks and impacted upper third molar. (See Fig. 13.)

raised from it. In the same way the position of the head affects the overlapping of the molar region by the shadows of the vertebræ at the posterior portion of the plate. The dark space above the upper teeth is formed by the maxillary sinus and the nasal fossa. Into this space occasionally may be seen projecting the coronoid process of the opposite side of the jaw. Above the maxillary sinus and nasal fossa, the honeycombed appearance is due to the ethmoid cells. Below the roots of

the lower molar teeth may be seen the mandibular canal, running forward to the mental foramen between and below the apices of the premolars. Below the lower border of the mandible, extending in front of the vertebræ as far forward sometimes as the first molar, the hyoid bone

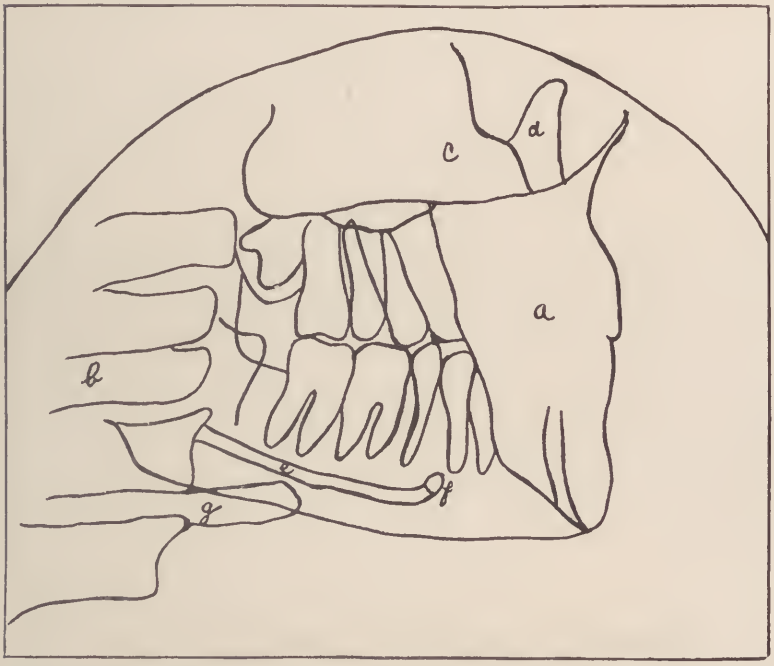


Fig. 13.—Diagrammatic illustration of Fig. 12. *a*, portion of upper and lower jaws overlapped by shadow of opposite side; *b*, vertebræ; *c*, maxillary sinus and nasal fossæ; *d*, coronoid process of right side of mandible; *e*, mandibular canal; *f*, mental foramen; *g*, hyoid bone.

is shown. In plates taken to show the molar region, the ramus and condyloid process of the mandible can frequently be traced up to the joint.

CHAPTER III

PATHOLOGY IN RELATION TO DENTAL ROENTGENOLOGY

One of the essentials of correct interpretation of roentgenograms of the teeth and their supporting tissues is a familiarity with the clinical course, pathology, and result of acute and particularly chronic inflammation involving these parts. The diagnostic value of the roentgen ray in inflammatory processes affecting the teeth and surrounding parts depends entirely upon variations in the density of the hard tissues as a result of the inflammation. In an acute localized infection, confined to one tooth, the inflammatory process usually is of too short duration to bring about an appreciable amount of destruction of bone tissue, and the roentgen ray is often of slight aid in a case of this kind. It is in the chronic, long-standing types of infection, or in an acute process grafted upon a chronic one that this method of diagnosis finds its greatest field of usefulness.

From a clinical and a pathologic standpoint there are in general two types of lesions about the teeth in which examination by the roentgen ray is an aid to diagnosis and prognosis. These are:

1. Lesions involving the periapical region of the tooth dependent upon infection following death of the pulp.

2. Lesions involving the investing tissues of the teeth—the peridental membrane and alveolar process—not dependent upon death of the dental pulp, but in which the infection starts at the gingival margin, so-called pyorrhea alveolaris, or more correctly, chronic suppurative osteopericementitis.

A third type of lesion is occasionally seen, the so-called *pericemental abscess,* in which an inflammatory process is set up in the pericementum of a tooth, independently of disease of the pulp, the latter retaining its vitality, or being only secondarily involved. In these lesions the infecting organisms usually gain entrance from the gum margin, or from neighboring diseased teeth, but may be carried from other parts of the body through the blood stream.

Periapical Dental Lesions

Lesions of this type are the most important with which we have to deal from a roentgenologic standpoint, because they often occur in the absence of clinical symptoms or signs, when roentgen examination becomes the principal means of diagnosis.

In the vast majority of cases of this type the disease results from infection following death of the dental pulp, the causative bacteria passing up the root canal and gaining access to the periapical tissues through the apical foramen of the tooth. Bacteria may also in a small percentage of cases be carried by the blood stream from other parts of the body and lodged in the periapical tissues of pulpless teeth or teeth containing necrotic pulp tissue. This infection may follow dental caries and inflammation and death of the pulp, traumatism, or artificial devitalization by the dentist. The use of arsenic for pulp devitalization, and the forcing of strongly irritating medicinal agents such as formaldehyde into the periapical region are important predisposing factors in leading to infection. Much has been said about the part played by various medicinal chemical irritants in the causation of these periapical conditions. It is easy to understand how such chemicals can be the starting point preparing the way for bacterial infection, but that they alone can induce a reactive process such as examination of

these diseased tissues reveals, continuing and progressing perhaps for years, is inconceivable, inasmuch as these chemical agents are limited in the duration of their action by the fact that they can not perpetuate themselves. It is only by the addition of a vital, self-propagating factor, that is, living bacteria, that such a long-standing inflammatory reaction can be explained. This view is confirmed by histologic and bacteriologic examination of the tissues involved. So we must regard *infection by living bacteria* as the essential cause of long-standing periapical lesions.

Failure on the part of the dentist to observe absolute asepsis in performing root canal operations is a frequent means of introducing streptococci from the mouth surface into the periapical tissues. The original infection in practically all cases of periapical disease is streptococcal. It is unnecessary here to discuss at length the work of Rosenow, Gilmer, and Moody, Hartzell and Henrici, and others, bearing upon this question.

The access of streptococci to the peridental membrane of the apical region in one of the ways mentioned, causes a typical inflammatory reaction on the part of the tissues, which is dependent upon the virulence of the invading organisms and the resistance of the patient. If the streptococcus is of the *hemolytic* type, of high virulence, and the patient's resistance is low, the inflammation is acute, and may result in acute abscess formation. If this occurs, after evacuation of the pus, and under proper treatment, the condition may rapidly subside with practically no detachment or destruction of the peridental membrane, and no appreciable destruction of bone.

In case the invading organism is of the *viridans* type, of low virulence, the inflammatory reaction is apt to be chronic, giving rise to little apparent disturbance, but slowly progressive and proliferative in nature. The first change seen in the peridental membrane is a *thickening*

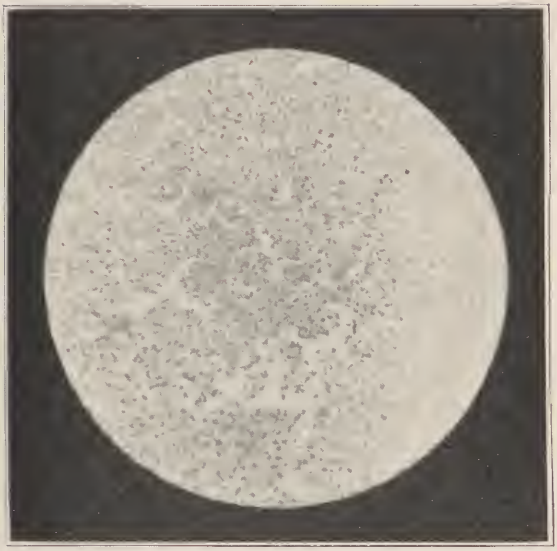


Fig. 14.—Inflammatory periapical tissue of the more acute type, showing preponderance of polymorphonuclear cells.

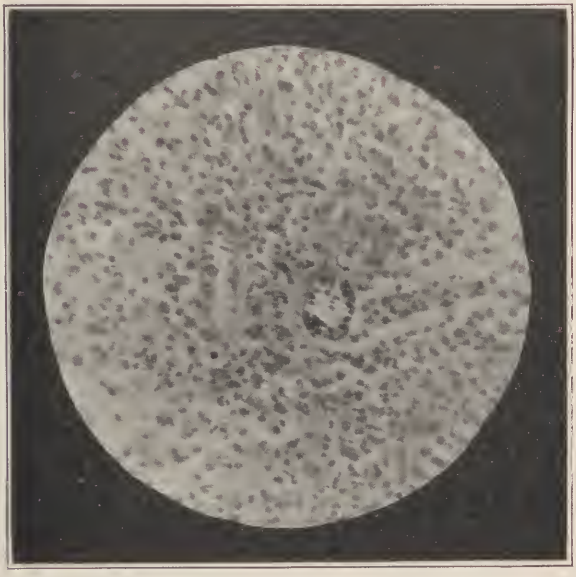


Fig. 15.—Chronic type of periapical inflammation. Preponderance of small round cells. Capillary blood vessels are seen, establishing a connection between the focus of infection and the general circulation.

of this tissue, which is infiltrated with various blood elements, but especially polymorphonuclear and small round cells, particularly the latter (chronic proliferative pericementitis). This peridental thickening takes place at the expense of the bone of the alveolar process, and as proliferation of round cells occurs, the bone becomes rarefied and finally destroyed (chronic rarefying osteitis), leaving a space filled with a mass of chronic inflammatory granulation tissue, the so-called *granuloma*. The granuloma is composed, therefore, of small round cells, polymorphonuclear and endothelial leucocytes, foreign-body giant cells, fibroblasts, capillaries, and fibrous tissue, and sometimes masses of epithelial cells, to which attention will be called later. From this tissue streptococci may be obtained both by direct smear and by culture. The histologic appearance of the tissue varies with the virulence of the infecting organism, the more virulent types of infection and those of short duration giving a preponderance of polymorphonuclear cells (Fig. 14), the more chronic types of infection showing few polymorphonuclears but many small round cells (Fig. 15), while in cases of long standing, the cellular elements are few, and fibrous tissue predominates (Fig. 16). Sometimes the granulation tissue breaks down, and is replaced by fluid pus which fills the bone cavity (*chronic abscess*), or the contents may consist partially of pus and partially of granulation tissue (*suppurating granuloma*). Such lesions containing fluid pus, however, are in a considerable minority, as compared to the solid or semisolid granuloma, and, therefore, the term "chronic abscess" is entirely inapplicable in the great majority of cases of periapical infection.

These areas of bone rarefaction and destruction vary greatly in size. The bone absorption is usually accompanied by a slow detachment and destruction of the peridental membrane covering the cementum at the root end,

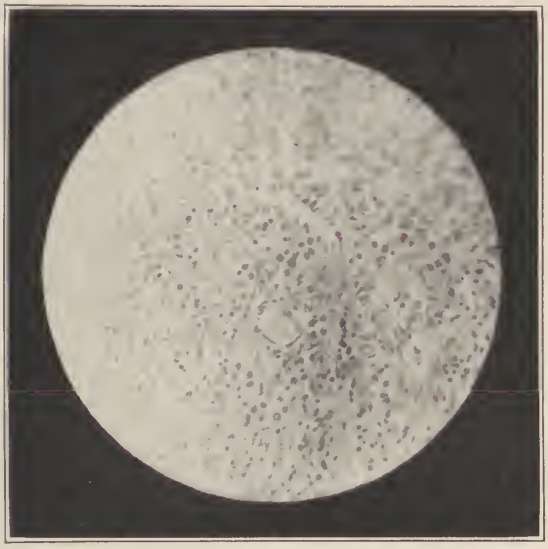


Fig. 16.—Case of long-standing periapical inflammation, showing fewer cells and preponderance of fibrous tissue.

Fig. 17.—Mass of squamous epithelial cells (debris epitheliaux paradentaires) embedded in chronic periapical inflammatory tissue.

thus depriving the latter of its blood supply, and converting it into a necrotic foreign body.

Coincident with the chronic abscess or granuloma formation, rarefaction and absorption of the necrotic cementum of the root apex takes place by the action of endothelial leucocytes and foreign-body giant cells. This is usually accompanied by the production of new cementum by cementoblasts that have not been destroyed, forming irregular thickenings of the root. Sometimes this hypercementosis is the principal lesion found.

The contents of the spaces produced by periapical bone absorption, including bacteria and their products, have direct connection with the general circulation through capillary blood vessels and lymphatics in the walls of the cavities and running in all directions through the granulation tissue. While the outer layers of the granuloma may be denser and more fibrous than its inner portion, there is no limiting membrane in the sense of preventing its contents from entering the general circulation.

After eradication of infection in a periapical bone area, new bone is usually formed, filling in the space after several months. The space at first contains blood clot, which, if sterile, organizes into fibrous connective tissue. Then the bone cells of the surrounding alveolar process deposit lime salts, the density gradually increasing until normal bone is the result. Occasionally this new bone is much denser than normal, due to excessive deposit of lime salts, and is shown in the odontogram as a light area. This dense bone, by pressure on sensory nerve filaments, may cause neuralgia.

Cyst Formation

Among the connective tissue elements of the inflammatory granuloma developing as a result of infection about the root apex are frequently found masses of squamous epithelial cells (Fig. 17). Similar cells are present nor-

Fig. 18.—Early stage of cyst formation, showing cavity lined with several layers of epithelium, with chronic inflammatory tissue at the periphery.

Fig. 19.—High power view of epithelial cyst lining.

mally in the peridental membrane, where they are known as *débris epithéliaux paradentaires* of Malassez. These epithelial cells are believed to be remains of the outer cells of the enamel organ which originally passed down and formed the outer wall of the sac in which the cementum of the root was formed. Proliferation of these epithelial cells found among the granulation tissue is stimulated by the chronic inflammatory process. The

Fig. 20.—Later stage of cyst formation, showing pressure atrophy of epithelial lining.

mass of epithelium then breaks down in the center, it is believed by fatty degeneration, and a space is formed containing fluid (Figs. 18 and 19). This cyst cavity gradually enlarges, the pressure of the fluid causing atrophy of the epithelial cells, until the wall of the cyst consists of a dense fibrous capsule lined with at most a few layers of epithelial cells (Fig. 20). All traces of epithelium may finally disappear. The cyst fluid is usually clear, straw-

colored, and may contain cholesterin crystals, recognized by their rectangular shape with a notch in one angle. The fluid is generally sterile, but infection of the cyst wall may convert it into pus from which various organisms may be recovered. Dental root cysts may vary considerably in size, from that of a small pea to a hen's egg (Figs. 254 and 307). In the maxilla, they may invade the maxillary sinus or the nasal fossa (Fig. 305). Cyst formation, contrary to the opinion of some authors (Thoma), is common in connection with periapical infection.*

Stages of Periapical Disease in Relation to Roentgenographic Abnormalities

The principal stages of chronic periapical disease giving rise to roentgenographic abnormalities may be summed up as follows:

1. Chronic Proliferative Pericementitis, producing a slight thickening of the peridental membrane about the tooth apex, but without appreciable loss of bone. In the odontogram this is shown by an increase in thickness of the normal dark line between the apical portion of the tooth root and the bone.

2. Chronic Rarefying Osteitis with Granuloma.—A slow disintegration of bone takes place in a circumscribed area about the tooth apex, the bone tissue being replaced by granulation tissue. The tooth apex may project into the bone cavity, may be shortened or roughened from irregular absorption of the cementum, or may present enlargements due to hypercementosis. In the roentgenogram these lesions are shown as more or less clearly defined areas of lessened density; i. e., darker than

*For a more detailed description of the histopathology of chronic periapical disease with a complete review of the literature of the subject, the reader is referred to the article by Henrici and Hartzell in the *Journal of the National Dental Association*, 1917, iv, 1061.

the surrounding bone. The irregular form of the apical end of the tooth root is also shown when present.

3. Chronic Rarefying Osteitis with Suppuration.—Here we have an area of bone destruction in which the space is entirely or partly filled with fluid pus. The apical peridental membrane is nearly always destroyed, the root end roughened, with the necrotic cementum bathed in pus. The infection in this type of lesion is to be regarded as more active than in the preceding form. The roentgenogram presents a blurred area of somewhat lessened density compared with the surrounding bone, with irregular and ill-defined margins, into which the roughened tooth apex projects. The more active the suppurative process, the more irregular and ill-defined will be the margins of the lesion in the odontogram.

4. Chronic Rarefying Osteitis with Cyst Formation.—This stage succeeds that of granuloma, the cavity in the bone being filled with clear fluid and often little soft tissue except a thin fibrous sac. In the roentgenogram, therefore, the cyst appears as a very clearly defined dark area involving the apices of one or more teeth. The margins are regular and very sharply defined, so that there is usually no difficulty in telling exactly where the healthy bone ends.

The basis for the foregoing classification consists in roentgenographic examinations checked up by subsequent extraction of teeth or surgical treatment followed by histologic and bacteriologic examination.

Infection of the Investing Tissues of the Teeth Beginning at the Gingival Margin—Pyorrhea Alveolaris

For a detailed discussion of the etiology and pathology of chronic suppurative pericementitis or pyorrhea alveolaris the reader is referred to Black's "Special Dental Pathology," and other works. Only such points will be

taken up here as have a direct bearing upon roentgen diagnosis.

This disease always begins as a gingivitis due to irritation of the gum about the necks of the teeth. Among these irritating factors may be mentioned: malocclusion, involving misapplied stress in mastication; improper contact of teeth produced by faulty restorative operations, permitting the wedging of food between the teeth with impingement upon the gum septum; imperfect margins of crowns and fillings, either pressing upon the gum tissue or permitting lodgment of food; lack of cleanliness, allowing deposition of calculus and food. Any of these causes will produce a local injury to the gum tissue, and permit infection by the microorganisms always present in the mouth. Various constitutional diseases, by lowering vital resistance are predisposing factors. At first the lesion is confined to the gum tissue (gingivitis), giving rise to no roentgenographic changes. Later, the peridental membrane is attacked (chronic gingivopericementitis), the infection progressing slowly from the gum margin toward the apex of the tooth. In the roentgenogram at this stage we may see a thickening of the normal peridental dark line. Very soon after involvement of the pericementum, the bone becomes affected (osteopericementitis), this being first manifested in the odontogram by absence of the apex of the bony septum between the teeth. The bone surrounding the tooth is now progressively destroyed toward the apex, and the entire bony support of the tooth may be lost. Sometimes sufficient bone remains in the apical region to give the tooth a good deal of firmness, and it is surprising how little bone may be indicated in the odontogram for this to be the case. In the roentgenogram the loss of bone is shown by a lessening in density which in advanced cases may completely surround the tooth. As the bony support is destroyed, the tooth may incline from its normal axis, particularly if an adjoining tooth has been lost.

Deposits of calculus upon the root and absorption and irregularities of the cementum are also shown. In molar teeth, chronic suppurative pericementitis may be shown in the odontogram as a dark area of absorption at the bifurcation of the roots.

Roentgenographic study of cases of chronic suppurative pericementitis is of importance in order to determine the extent of bone destruction in deciding the line of treatment to be followed. It is also of value in showing new bone formation in the course of treatment of a case.

CHAPTER IV

CORRELATION OF CLINICAL FINDINGS WITH ROENTGENOGRAPHIC EXAMINATION

Errors in diagnosis of tooth conditions are frequently observed owing to lack of coordination of the clinical, roentgenologic, and other parts of the examination. The roentgen examination is frequently made and the findings reported independently of or entirely without a clinical examination of the mouth, and vice versa. On account of this, important pathologic conditions are sometimes overlooked; or, on the other hand, undue significance may be attached to the findings of either examination.

False interpretation of dental films by roentgenologists is not infrequent. On the other hand, cases are often seen in which clinical examination alone, without the roentgen ray, failed to reveal serious lesions that were present.

In order that these errors may be avoided as far as possible, a definite routine should be followed preliminary to making the roentgen examination, particularly where a complete examination of the teeth and surrounding parts is desired, in the detection of any possible foci of mouth infection.

Routine Examination

First of all, the person upon whom the interpretation of the roentgenograms devolves, should know as much as possible of the *history* of individual teeth of the patient, in regard to previous treatment, abscesses, swellings, pain, etc. A knowledge of particulars of this kind may vitally modify the interpretation.

A general survey of the mouth and associated parts should be made. In this way the examiner obtains a

clue as to the nature and extent of the roentgenologic examination required. The presence of pyorrhea, ulcerations, suppurating sinuses, swellings, etc., is noted.

Electric Test.—The next important step consists in determining and noting down on a chart, so far as possible the condition of each tooth in regard to vitality of the pulp, which teeth are crowned, and which are missing. The most convenient and reliable method of determining pulp vitality is by means of the faradic battery, shown in Fig. 21. This battery contains one dry cell. The negative electrode is held in the hand of the patient.

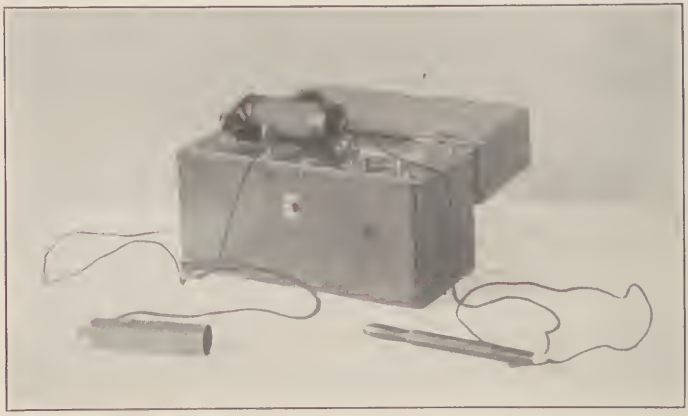


Fig. 21.—Faradic battery used to test pulp vitality.

The positive pole consists of a pointed dental exploring instrument mounted on an insulated handle. The point is wrapped with a wisp of cotton and dipped in water. Starting at the median line of the upper jaw, each tooth presenting an enamel surface is touched in turn with the moistened electrode, and the result noted as minus, plus or doubtful. Crowned teeth are marked "C," and missing teeth "M." This chart then forms the basis for the roentgen examination, which is to be applied to all places in the mouth showing negatively responding, crowned, or missing teeth. The teeth with vital pulps can usually

be ignored, as they are practically never the seat of hidden apical disease. Of course, it may frequently be necessary to subject teeth with vital pulps to roentgen examination to show the amount of bone destruction due to pyorrhea. The faradic test is not absolutely infallible in determining the vitality of the pulp, but it is the best means that we have at present. A false negative result may be obtained sometimes in teeth with recession of the pulp and formation of secondary dentine, while a false positive response may be due to the presence of large metallic fillings conveying the current to the gum or to contiguous vital pulps. For this reason also, the current is not reliable in determining the vitality of pulps beneath shell crowns. In such cases it may be necessary to remove the crown and then apply the test. A nervous patient, too, may imagine he feels a response in a pulpless tooth after receiving several shocks in succession through vital pulps.

The foregoing steps in the mouth examination are to be regarded as preliminary or leading up to the roentgenographic examination. Without them as a guide we should be forced either to pick out certain suspected areas for roentgenographic study, thus many times overlooking far more important conditions, or, as is done by many roentgenologists, make films showing every tooth in the mouth, which is obviously a waste of time and material, and also frequently incomplete.

We endeavor to overcome the defects of the usual methods of examination by the following plan:

First of all a *plate* (5x7 inches) is made of each side, taking in all the teeth of the upper and lower jaws from the canines backward, and also showing the region of the angle and ramus. This gives a general survey of the mouth, discounting any preconceived ideas as to conditions expected to be found. Unsuspected abnormalities are in this way frequently discovered, which would be

overlooked if only certain areas or even the usual locations of teeth were covered with films; in addition to this, pathologic conditions about lower premolars and molars are generally more satisfactorily shown in plates than in films. Owing to trismus, it may be impossible to place a film within the mouth. After exposing the plates, each single area comprising teeth either crowned or negative to the electric current, or considered to require more detailed study than is shown in the plate, and any area in the front part of either jaw from which teeth are missing, is covered with a small film. The film picture shows the opposite aspect of that which is shown in the plate, this being due to the fact that the plate is extraoral, and the film intraoral.

By following this routine, we have been rewarded many times by the detection of unerupted teeth, especially third molars, cysts, odontomas, roots in the maxillary sinus, diseased maxillary sinuses, etc., which might easily have been overlooked had films been depended upon alone. One of the fundamental principles of a general physical examination is the importance of surveying the body as a whole. In the same way, in this special field, we should examine the entire mouth, not blindly, but in an intelligent manner, instead of selecting suspected areas here and there with films. Of course, as a guide in the treatment of individual teeth, a film exposure usually is sufficient.

Record of Examination

Fig. 22 shows the record of a specimen case. At the top is a chart of the teeth, with the results of the faradic test; crowned and missing teeth are also marked. Below are shown the plates of the two sides, with films covering the pulpless and crowned teeth in the upper jaw. For the lower teeth the plates alone usually are sufficient. In this case our interpretation should read about as follows:

Upper Right.—Central incisor crowned, imperfect

root filling, periapical rarefying osteitis with suppuration, and absorption of root; there is also a perforation of side of root; first premolar, devitalized pulp, no root filling, periapical rarefying osteitis with granuloma; this area extends to the periapical region of the second premolar, previously extracted; first and second molars pulpless, partial root fillings, periapical regions normal.

Upper Left.—Central incisor crowned, partial root filling, small area of periapical rarefying osteitis with granuloma; lateral incisor pulpless, good root filling, peridental thickening about apex; canine pulpless, good root filling, apex normal; first premolar crowned, imperfect root fillings, slight peridental thickening about apices; second premolar crowned, partial root filling, small area of periapical rarefying osteitis with granuloma; first molar has been previously extracted, and at this point is a large area of bone destruction, probably with cyst formation.

Lower Right.—Second premolar pulpless, partial root filling, periapical region normal; second and third molars crowned, partial root fillings, periapical rarefying osteitis, probably with granulomas, about the teeth.

Lower Left.—Second molar crowned, partial root fillings, periapical region apparently normal; the crown on this tooth has an overhanging edge, permitting the collection of food and debris.

Positions Used in Exposing Plates and Films

While this book is primarily intended to throw light on the *interpretation* of dental and maxillary roentgenograms, it is not considered out of place to briefly describe the positions used by the writer in exposing the plates and films.

Most operators in making roentgenograms of the head and teeth place the patient in the recumbent position, which entails considerable preparation and discomfort.

According to the following technic the work is done with the patient in a sitting posture on a chair facing the stand. A stand of a well-known make is employed. To

Fig. 22-*A*.

Fig. 22-*B*.

A.—Diagram of teeth, with faradic reaction, etc., indicated.
B.—Plate of left side.

it is added a standard head clamp, and a plate rest specially designed by the late Dr. E. J. Eisen. The

Fig. 22.-*C*.

Fig. 22-*D*.

Fig. 22-*E*.

Fig. 22-*F*.

Fig. 22-*G*.

Fig. 22.

C.—Plate of right side. *D* and *E*.—Films of upper left teeth.
F and *G*.—Films of upper right teeth.

plate rest is fixed at an angle of 15 degrees downward from the horizontal, and is placed 19 inches from the target. The tube holder and funnel are drawn out to the full length of the horizontal arm of the stand, and tipped inwardly at an angle of 30 degrees from the vertical (Fig. 23). A 5x7 inch plate with the emulsion side up is placed on the plate rest. The patient is now seated somewhat to the right or left of the stand with the head laid on the

Fig. 23.—Eisen plate rest attached to stand for taking head plates.

plate in such a position that the focal ray will pass through the mastoid process of the uppermost side of the head (Fig. 24). This position brings the uppermost side of the mandible in as nearly a perpendicular position as possible to the plate, thus minimizing overlapping of the two sides. If canine and premolar regions are particularly desired, the patient's nose should be pressed against the plate, while for molars the nose should be slightly

raised from the plate. The head clamp is now tightened, and the exposure made.

For intraoral films, the angle of the tube holder is reversed as shown in Fig. 25, the patient's head being supported by an ordinary head rest attached to the back of the chair. As a rule, no sort of film holder other than the patient's thumb or finger is necessary, though occasionally the cork devised by Dr. M. L. Rhein is of advantage. The film fits into a slot cut in the cork and by this means

Fig. 24.—Position of head and angle for left side of jaws.

is held between the patient's teeth. The emulsion side of the film is always placed against the teeth to be taken.

Modifications of these routine positions must, of course, be made to suit individual cases. Where symptoms suggest the possibility of disease of the nasal accessory sinuses, or where it is suspected that dental infection involves the maxillary sinus, roentgenographic examination of these parts is often of value. This is carried out by using the technic described by Waters and Waldron (*American Journal of Roentgenology*, February, 1915),

for which this stand is well adapted. An 8x10 inch plate is used, at 22 inches from the target. The patient is seated directly in front of the stand,—if a woman, with all hairpins removed—and the head placed on the plate rest with the chin touching the plate and the nose not quite touching. The tube holder is tipped until the base of the funnel is parallel with the plate, and the focal ray directed toward the root of the nose. (Fig. 26.) By

Fig. 25.—Position for exposing intraoral dental films.

means of a plate of this kind the two sides of the face can be compared and empyema of the antrum of Highmore or of the other sinuses detected by increased opacity to the rays as compared with the healthy side. It is seldom possible from a plate or film showing conditions only on one side to detect the presence of pus in the antrum, but by the addition of the sinus plate just described, the diagnosis may often be completed. Fig. 27 shows opacity of

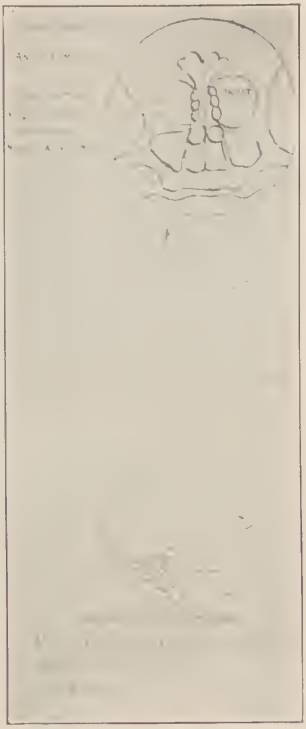


Fig. 26.—Diagram showing position for exposing sinus plate, and projection of the sinuses on the plate.

Fig. 27.—Opacity due to empyema of left maxillary sinus.

the left maxillary sinus, due to empyema. Still further information may be obtained when necessary by making lateral or vertical views of the sinuses.

Horizontal Films.—Valuable information can frequently be obtained by the intraoral use of a 2¼ x 3 inch film. In the case of the maxilla the film is inserted horizontally between the upper and lower teeth with the emulsion side up, and the rays directed from above. In the case of the mandible, the film is reversed and the rays directed from below. Figs. 28 and 29 illustrate the angles at which the perpendicular rays should enter in using these films in the horizontal position. This method gives a more comprehensive view of several teeth and adjacent region than the use of the ordinary small film, and is particularly valuable in studying cysts, and unerupted teeth in the maxilla, and fractures in the region of the symphysis of the mandible. Figs. 356 to 403 are illustrations of the use of this method.

Identification of Given Plates and Films with the Sides and Parts of the Mouth to Which They Belong

Provided that plates and films have been made according to the technic described, how is one who has not witnessed the examination to determine which teeth are depicted in a given plate or film?

Plates.—In exposing a plate, it is recalled that the side of the face to be shown is laid against the *emulsion* surface and the rays directed from the opposite side of the head. Therefore, a finished plate of the *right* side, with the emulsion surface toward the observer, should look toward the left, while a plate of the *left* side should look toward the right.

Films.—In making a film, it is placed in the mouth with the emulsion surface toward the inner or lingual

Technic for Horizontal Films—Upper

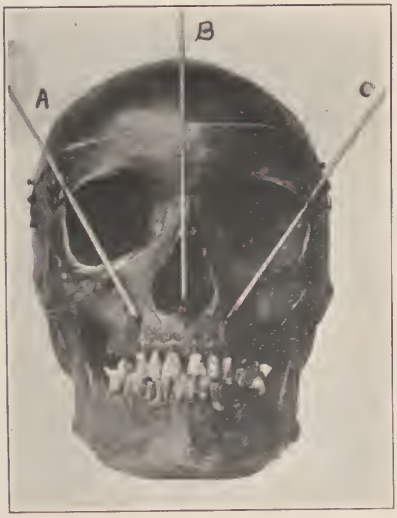


Fig. 28.—Showing the angle at which the perpendicular rays should enter when making large horizontal views of the maxilla. *(A)* Angle used when taking radiogram of the upper right premolar and molar region. *(B)* Angle used when making radiogram of the palate and anterior teeth. *(C)* Angle used when making radiogram of the upper left premolar and molar region.

Technic for Horizontal Films

Fig. 29.—Showing the angle at which the perpendicular rays should enter when making horizontal views of the mandible. *(A)* Angle used when making radiograms of the symphysis of the mandible. *(B)* Angle used when making radiograms of the floor of the mouth.

aspect of the teeth, and the rays directed from the same side of the head. A finished film should be viewed with the *shiny* surface toward the observer. In the case of the anterior teeth, the uppers and lowers are distinguished by their size and shape. The teeth on the right side will be to the right of the film, and the left to the left. Films of upper posterior teeth are frequently distinguished by showing outlines of the maxillary sinus, while in lower films, the occlusal line of the teeth is generally concave, and the mandibular canal and mental foramen may be shown. The upper and lower molars are also distinguished by the number of their roots. With an upper film held with the roots of the teeth pointing upward, and a lower film with the roots pointing down, shiny side of film toward the observer, the hindermost teeth of a film of the *right* side will be toward the right of the film, and the hindermost teeth of a film of the *left* side will be to the left of the film. This explanation is difficult to give in words, but after a little practice the recognition of the part of the mouth to which a film belongs becomes automatic. In the illustrations shown throughout the book, the rules just given have been followed.

CHAPTER V

ROENTGENOGRAPHIC FINDINGS ABOUT THE TEETH AND JAWS IN THEIR RELATION TO PROGNOSIS AND TREATMENT

The physician is frequently called upon to decide or give advice on the question of saving or removing teeth which have caused or are associated with given pathologic conditions as revealed by the roentgen ray. While each case must be considered individually, yet it is possible to lay down certain rules for general guidance. Like all generalities, they are subject to exceptions and modifications.

The diagnosis of periapical pathologic conditions about the teeth depends upon the history, the symptoms, the clinical examination, and the roentgen examination. When these have resulted in a diagnosis, one of three methods of treatment so far as the tooth is concerned, is to be considered; namely, (1) conservative treatment; (2) surgical removal of the diseased condition by resection of the root with curettement of the diseased bone area; and (3) extraction of the tooth followed by curettement of the diseased bone area.

Many times teeth are condemned for extraction which could be safely retained by proper treatment, owing to lack of discrimination on the part of the physician.

On the other hand, the training of the average dentist does not permit him to grasp the broad pathologic aspect of the question, with the result that he may often attempt conservation of teeth which may be a danger to the life of the patient, and labor under the mistaken belief that

he has by inadequate treatment freed teeth from infection when in reality they still remain a menace.

Until dentists become more familiar with diseased conditions of the body in general, the responsibility in this matter in patients suffering from systemic infection with foci in the mouth should lie with the physician, and this necessarily requires on his part a familiarity with roentgenographic interpretation of these dental conditions. In the formation of an opinion as to whether conservative or operative treatment should be carried out, the question of the training of the dentist for this particular work must be considered. Unless the dentist is familiar with modern methods of aseptic root canal work, and is guided and checked in his operations by the roentgen ray, by far the safest procedure is the immediate extraction of any tooth in which the pulp chamber is entered by decay, whether or not periapical infection be demonstrated. If the patient is in the hands of a competent dentist, with a sense of surgical asepsis, and familiar with modern accessories that have been found by the best workers to be essential, much can be accomplished in the saving of many teeth that show distinct evidence of extension of infection to the periapical region.

The question of conservative or radical treatment of teeth showing periapical involvement should first of all be decided by the general health of the patient. Our attitude toward treatment of suspected diseased teeth in patients who have some systemic condition in which mouth infection is possibly playing a part should be much more radical than that adopted in patients having no physical ailments. Many times a tooth may be passed along for treatment in a healthy individual where in an invalid a tooth so affected would be removed without hesitation. So far, no reliable or satisfactory preoperative pathologic means of proving the connection between suspected peridental areas and systemic conditions has

been discovered, so at present we must take the risk of occasionally sacrificing a harmless tooth, which is a small matter when weighed in the balance against the general health of the individual.

Periapically diseased teeth, as shown by the roentgen ray and other means of examination fall into two general groups so far as treatment is concerned: (1) those which should unquestionably be extracted under all conditions, and (2) those in which more conservative treatment may be attempted.

1. In the first group fall teeth showing the following conditions:

(A) Large periapical areas of chronic rarefying osteitis in which one-third or more of the peridental membrane has been lost and in which the cementum is eroded and absorbed.

(B) Teeth in which the side of the root has been perforated and infection of the lateral peridental membrane with bone destruction has occurred.

(C) All upper molars and all lower teeth with extensive periapical areas of chronic rarefying osteitis with granuloma, suppuration, or cyst formation, or even comparatively small areas in which the x-ray reveals root roughening or absorption, because the locations of these teeth are not as a rule favorable for root resection.

Teeth falling in Classes A, B, and C should be unhesitatingly extracted regardless of whether the patient is otherwise healthy or not.

2. In the second group are found teeth in which in otherwise healthy individuals an effort at conservation may be attempted by measures directed toward opening, draining, and sterilizing root canals and periapical areas, followed by root canal filling, and in some cases finally completed by root resection. Such teeth, with appropriate treatment indicated, may be classified as follows:

(D) Teeth showing peridental thickening in the apical

region, due to chronic proliferative pericementitis may be treated by opening, draining, sterilizing, and filling root canals after negative culture, followed by periodical roentgen examinations.

(E) Teeth showing small areas of periapical bone destruction with granuloma may be treated as in Class D, followed by apical root resection and curettement, in the case of upper incisors, canines, and premolars, and extraction when located in other parts of the mouth, if examination three months later shows no reduction or obliteration of periapical area.

(F) Upper incisors, canines, and premolars, with larger periapical areas of granuloma, suppuration or cyst formation, with or without roughening and absorption of apical cementum, and even smaller areas associated with the latter condition should be treated by the usual root canal opening, sterilization, and filling, and immediate apical root resection and curettement followed by extraction if at the end of three months the x-ray reveals no attempt at bone regeneration in the area involved.

Teeth falling in Classes E and F, and occasionally also in Class D should be extracted without attempts at conservative treatment in cases in which they are believed to be the cause of systemic infection.

Chronic Suppurative Pericementitis or Pyorrhea

As regards the treatment of teeth involved in this condition, the following general rules may be followed:

Teeth where the surrounding bone destruction is so great as to deprive the tooth of over one-third of its support, should be extracted.

Multirooted teeth in which the bone destruction and granulation tissue have extended to the bifurcation of the roots, should be extracted.

Teeth in which suppuration from pyorrheal pockets

resists persistent attempts at conservative treatment or treatment by gum amputation, should be extracted.

It is felt that physicians advising and dental surgeons carrying out treatment in accordance with the general rules outlined above, in the majority of cases, will be open to criticism neither for ultraconservatism on the one hand, nor for undue radicalism on the other, but will be following a sane middle course.

CHAPTER VI

STEREOSCOPIC AND OTHER METHODS OF LOCALIZATION

Roentgenograms, as ordinarily made, are flat pictures; i. e., they do not give any perspective, and it is impossible in such a picture to determine the relative positions of given parts except in two dimensions. In the majority of dental conditions in which the roentgen ray is an aid in diagnosis, the simple flat odontograms give all necessary information; but occasionally one meets with a case in which other methods are called into use with advantage. In the case of an unerupted canine, for instance, it is impossible to determine from a single film whether the unerupted tooth lies on the labial or the palatal aspect of the other teeth, and clinical signs of its position are often lacking.

We have two means of gaining a more accurate knowledge of the relative positions of different objects in the roentgenogram: (1) stereoscopic method; (2) by making two or more odontograms in different positions, and comparing the several pictures.

Stereoroentgenography

In the case of an unerupted impacted tooth, a foreign body, or a fracture, the information obtained from a stereoscopic view is often of inestimable value, the method yielding as it does a picture of almost equal clearness and perspective as would be obtained by actual visual examination through the hard tissues involved.

In making stereograms of the teeth and jaws either plates or films are employed, according to the location

and extent of the area involved. For showing conditions about individual teeth, especially in the front of the mouth, films may be used, while plates are more suitable in cases involving the posterior part of the mouth, such

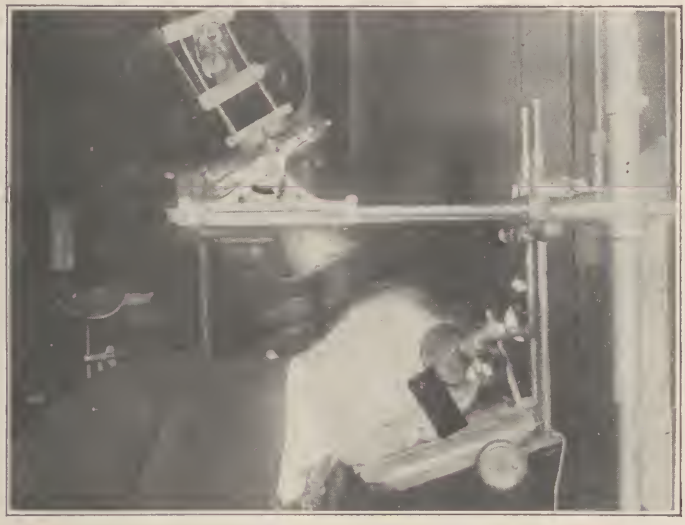


Fig. 30.—Position and angle of tube for first exposure in plate stereogram of the jaws.

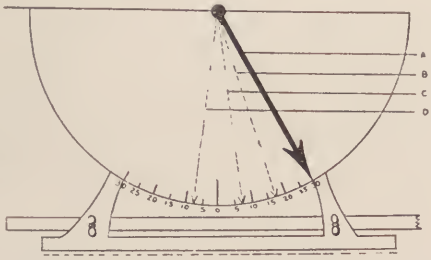


Fig. 31.—Diagram giving the angles of the tube in making stereograms of the jaws and teeth.

as impacted third molars, or where a considerable area is to be examined, as in the case of fractures, embedded bullets, etc.

Technic

The technic of *plate* stereograms will be described first. The operation involves making two exposures with the

tube in different positions. The first exposure is made with the same position of tube and patient as for a single plate described on p. 56. (Figs. 30 and 31-*A*.) The patient is instructed to keep the head in exactly the same position for the two exposures, as any movement will interfere with the stereoscopic effect. Care must also be taken to place the second plate in exactly the same position as the first, which is easily accomplished by means

Fig. 32.—Position and angle of tube for second exposure in plate stereogram of the jaws.

of lines ruled on the plate rest or by means of a special slot arrangement in the plate rest into which the plates can be slipped. The first plate having been slid out from under the patient's head and the second plate placed in the same position, the tube is shifted three inches in toward the upright stand. In order for the central ray to strike the second plate at the same point as in the first, it becomes necessary to change the angle of the funnel

from 30 degrees to 17½ degrees from the vertical (Figs. 32 and 31-*B*). The second exposure is now made, exactly the same time being given as in the first exposure. After development, the plates may, of course, be viewed through the large Wheatstone stereoscope. If this instrument is not available, lantern slides or prints can be made from corresponding parts of the two plates, and viewed very satisfactorily through the ordinary hand stereoscope. In viewing these plates through the stereoscope, it must be remembered that they must be placed sideways, owing to the direction in which the tube was shifted between the exposures.

In mounting the lantern slides for the stereoscope a cover-glass is made by washing the emulsion off an old 5x7 inch plate, cutting it down to 4x7 inch, and fastening the slides to this with paper or cloth binding strips. Fig. 31 illustrates the value of stereoscopic roentgenography in locating an unerupted impacted upper third molar. There were no signs to indicate the position of this tooth by ordinary examination. Ordinarily such a tooth would be assumed to lie *disto-buccally* in relation to the second molar, and a single x-ray plate would only confirm this assumption. Stereoscopic plates, however, showed that the third molar lay on the *disto-palatal* aspect of the second molar. The operative incision was made at this point, the tooth readily found, and laceration of the buccal side of the gum was avoided.

In making intraoral films stereoscopically, the most important points to be observed are that the patient's head and the film must maintain the same position for the two exposures. The angles for the tube holder are based on a working distance of sixteen inches from target to film. The plate rest is first removed from the stand. The tube holder is then tipped sidewise at an angle to suit the individual case in the plane at right angles to the dental arch of the patient. In the plane parallel to the dental arch,

Fig. 33.—Stereogram showing unerupted impacted upper third molar lying to lingual side of arch. The sideways position of the pictures is made necessary by the direction of shifting of the tube.

the funnel is in a vertical position. (Fig. 34.) The patient is now seated in the chair, with the head supported by the head rest in such a position from the end of the funnel that with the film in the mouth against the teeth to be studied there will be approximately a distance of sixteen inches from target to film. The position should also be adjusted to avoid distortion as much as possible. This "centering" having been accomplished, the tube is placed in position for the first exposure by moving it one and one-half inches to the left of the central point, and tipping it inward at an angle of 7½ degrees from the vertical plane. This will bring the focal ray to the same spot on the film as with the tube in the central position (Figs. 35 and 31-*D*). After the first exposure has been made, the second film is quickly inserted in the same position in the mouth as the first, care being taken not to move the patient's head. The tube is now shifted three inches to the right and tipped at an angle of 7½ degrees from the vertical in the opposite direction from that of the first exposure, so that the central ray will again converge at the same spot on the film (Figs. 36 and 31-*C*).

In viewing films through the stereoscope the difficulty in mounting them so that identical objects in the two films will fuse readily is overcome by the following plan: a piece of glass is cut from an old 5x7 inch plate to a suitable size to fit the stereoscope (4x7 inches). To this are applied pieces of paper binding strip which have been previously folded longitudinally so that only about one-third of the original width of the gummed side is exposed. In this manner two slots are formed into which the films will fit at approximately the proper distance apart. The films are thus not mounted in absolutely fixed positions, but can be slid up and down and even slightly obliquely, so that they can be readily adjusted to such positions that the two images will merge when focused (Fig. 37). Fig. 38 is a view of the ordinary hand stereoscope. It is not

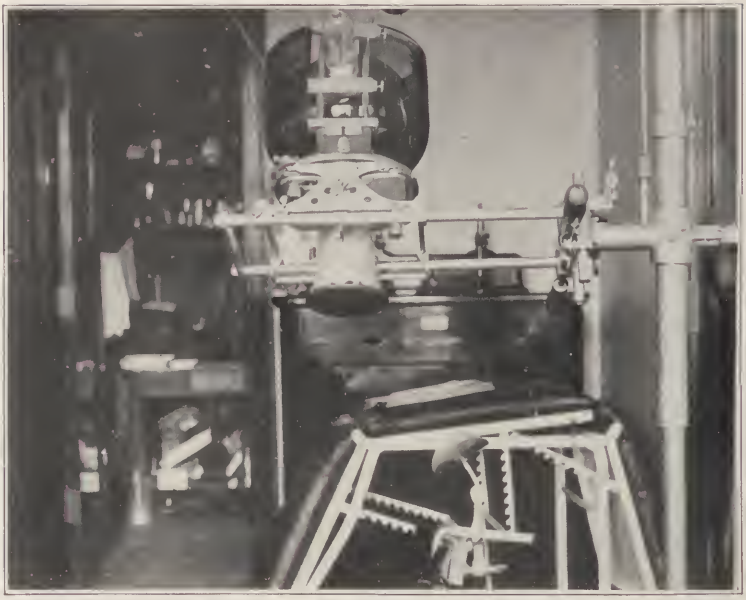


Fig. 34.—Central position of the tube prior to making stereoscopic film exposures.

Fig. 35.—Position of tube for exposure of first film in making dental stereogram. Tube tipped inward at angle of 7½ degrees.

satisfactory in a bound volume to give illustrations to be viewed stereoscopically.

Localization by Comparison of Two Films Taken in Different Positions

This method is very useful in determining, for example, whether an unerupted tooth lies upon the lingual or the

Fig. 36.—Position of tube for exposure of second film in making dental stereogram. Tube shifted and tipped outward at angle of 7½ degrees.

labial aspect of the other teeth. The principle involved is explained by the following example:

(1) Given two objects, standing in a straight line with the observer, the more distant will be covered by the nearer.

(2) If the observer moves toward the right, the more distant object will now appear to be to the right of the nearer one.

(3) Again, if the observer moves toward the left, the

nearer object will appear to be to the right of the farther one.

In other words, the more distant object apparently moves in the same direction as the observer, while the

Fig. 37.—Method of mounting stereoscopic films so that they may be adjusted to desired positions.

Fig. 38.—Hand stereoscope.

nearer object apparently moves in the opposite direction. This is further brought out by continuing the lines of observation through each object on to a screen as indicated in the diagram. (Fig. 39.)

Applying this principle now to roentgenographic films,

if an unerupted tooth is to the lingual side of the other teeth; i. e., farther away from the source of the ray, and two films are made, one a little farther to the right than the other, the unerupted tooth in the second film will appear to be farther to the right than in the first film. On the other hand, if the unerupted tooth lies to the labial side of the other teeth, i. e., nearer the tube, it will appear to be farther to the left in the second film than in the first.

In locating unerupted canine teeth, which frequently give no other indications whatever as to their lingual or labial situation, this principle yields valuable assistance, in cases where stereoscopic films may be difficult to obtain.

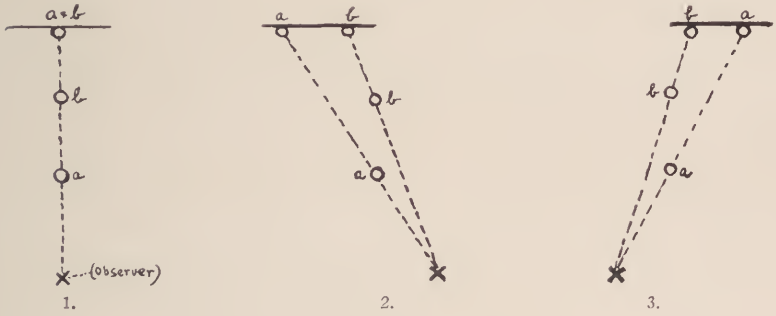


Fig. 39.

1. Two objects in a straight line with the observer; the more distant one is covered by the nearer.
2. Observer moves to the right; the more distant object is apparently to the right of the nearer one.
3. Observer moves to the left; the nearer object is apparently to the right of the more distant one.

No claim to originality is made in describing the above method, which, so far as I am aware, originated with Mr. C. A. Clark in Bennett's *Science and Practice of Dental Surgery*. The ease and certainty with which it has given the desired information in numerous cases warrants its more frequent adoption and recognition, which up to now has apparently not been generally accorded. Practical examples of the method are illustrated in Figs. 264, 265, 266, and 267, pp. 139 and 140.

PART II

CHAPTER VII

INTERPRETATION

This section is devoted to a detailed description and interpretation of numerous illustrations. Reproductions of films are presented showing both normal and abnormal conditions in every part of the mouth, grouped conveniently for comparative study.

The interpretations given are in conformity with the anatomic, pathologic, and clinical data discussed in the preceding chapters.

The reproductions of all plates and films have been made so as to resemble the originals as closely as possible. Though the double reduplication rendered necessary in carrying this out entails some loss of detail which would perhaps not be so marked were simple prints of the negatives used, it is believed that shortcomings in this respect are outweighed by the closer resemblance to the originals in regard to light and dark areas. The descriptions of the reproductions, therefore, would apply equally to the originals, without any change whatever. In illustrations of roentgenograms of some other parts of the body, this transposition back to the original form is perhaps not so important because these other regions are also examined fluoroscopically, in which case the parts appear as they do in a print; i. e., the bones and dense tissues appear as shadows instead of light areas as in the negative. Since the fluoroscope is rarely applicable to dental examination, and negatives are nearly always used, it has been considered advisable to reproduce the illustra-

tions as negatives, so as to more closely approach the conditions of examination in actual practice.

In the latter part of this section are described several x-ray plates showing various conditions such as impacted third molars, cysts, fractures, etc., in which plates are frequently of more value than films.

Upper Anterior Region

Fig. 40.

Fig. 41.

Fig. 40.—Upper centrals and right lateral normal. Dark area at top on right side is nasal chamber.

Fig. 41.—Upper right central, lateral and canine: Pulps vital, no periapical abnormality. Floor of nose and maxillary sinus barely shown as dark shadows above. The thin dark line "which is the peridental membrane" and the dense white line, "which is the lamina dura" are seen about the roots. Fillings shown as dense white spots.

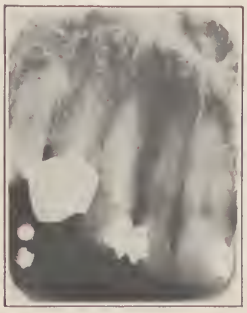


Fig. 42.

Fig. 43.

Fig. 42.—Upper left central, lateral, canine and premolars: Imperfect root canal fillings in canine and first premolar, shown by white line in root; no periapical abnormalities shown. Ill-fitting shell crown on first premolar.

Fig. 43.—Upper central incisors: Sharply defined dark area between roots is anterior palatine fossa, somewhat resembling the appearance of bone destruction and cyst formation. Both teeth, however contain vital pulps, and normal peridental line can be followed around each root.

Upper Anterior Region

Fig. 44.

Fig. 45.

Fig. 44.—Upper right central and lateral incisors: Both teeth probably contain vital pulps; periapical tissue normal.

Fig. 45.—Upper left central and lateral incisors: Pulps vital as shown by faradic test; no evidence of periapical abnormality. Some interdental alveolar bone destruction (pyorrhea).

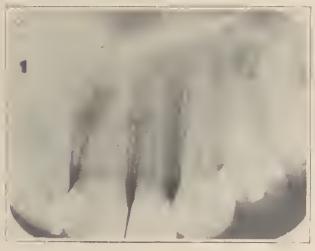


Fig. 46.

Fig. 47.

Fig. 46.—Upper right central, lateral and canine: Large fillings in these teeth; pulps respond to faradic test; no periapical disturbance.

Fig. 47.—Upper central incisors: Pulps vital, no periapical abnormality. Left lateral missing. The dark area between the centrals is caused by the anterior palatine fossa.

Upper Anterior Region

Fig. 48.

Fig. 49.

Fig. 48.—Upper left central shows carious condition extending to its apical third. Decided loss of the surrounding alveolar process; apical third of the canal is calcified. Dark area above is the nasal fossa. Left lateral and right central normal.

Fig. 49.—Upper right central forms abutment to poorly fitting bridge, which extends to left canine. Upper left central and lateral have been lost. No periapical abnormalities. The dark area above is the nasal fossa.

Fig. 50.

Fig. 51.

Fig. 50.—Upper right lateral incisor shows post for support of crown, no other root filling; ill-defined dark area about apex due to chronic rarefying osteitis with suppuration. Nasal fossa with inferior turbinate well shown above.

Fig. 51.—Upper right lateral incisor contains devitalized pulp (faradic test) under filling. Ill-defined dark area about apex due to chronic rarefying osteitis with suppuration.

Upper Anterior Region

Fig. 52.

Fig. 53.

Fig. 52.—Upper right lateral incisor with root filling extending over apical end of root which shows absorption; fairly well-defined dark periapical area, due to chronic rarefying osteitis with granuloma.

Fig. 53.—Upper left lateral incisor, imperfect root filling; irregular absorption of apex; clearly defined rounded dark area, probably due to cyst formation; would expect also to find some granulation tissue present. Pulp vital in central incisor, though the apex of the latter is apparently involved in the diseased area.

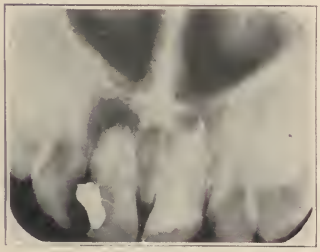


Fig. 54.

Fig. 55.

Fig. 54.—Upper right central incisor, good root filling extending slightly beyond apex, periapical region normal. Upper left central contains devitalized pulp, shows irregular absorption of root, and rarefying osteitis with granuloma. Nasal fossæ with inferior turbinates are well shown above.

Fig. 55.—Upper left central incisor crowned, imperfect root filling, irregular absorption of root, and chronic rarefying osteitis with granuloma. Upper right central has been lost and replaced by a bridge.

Upper Anterior Region

Fig. 56.

Fig. 57.

Fig. 56.—Upper right canine bridge abutment showing a perforation of the root at the middle third. Extensive loss of the alveolar process in canine region.

Fig. 57.—Upper right central, pulp vital, periapical tissue normal. Lateral incisor crowned, imperfect root filling, chronic rarefying osteitis with granuloma. Nasal chamber seen above.

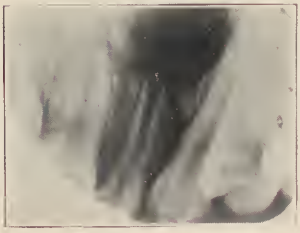


Fig. 58.

Fig. 59.

Fig. 58.—Upper right lateral showing undeveloped root with a large well-defined area above the apex which is a cyst.

Fig. 59.—Upper left central and lateral incisors crowned, imperfect root fillings; apices surrounded by large dark area due to chronic rarefying osteitis and granuloma.

Upper Anterior Region

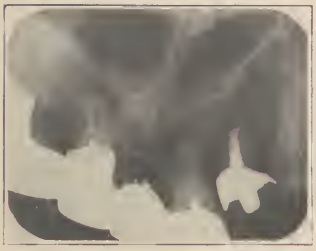


Fig. 60.

Fig. 61.

Fig. 60.—Upper right central and left lateral incisors, forming supports for bridge: The central incisor contains imperfect root filling, and shows dark area due to rarefying osteitis and granuloma about apex. Left lateral shows poorly outlined area due to osteitis with suppuration. The bony support of this tooth has been largely destroyed on the distal aspect. Right lateral incisor crowned, root filling passing through apex into area of bone destruction with granuloma.

Fig. 61.—Upper right central incisor contains vital pulp and shows no periapical abnormality. Lateral shows traces of root filling and large well-defined area about root indicating chronic rarefying osteitis and cyst formation.

Fig. 62.

Fig. 63.

Fig. 62.—Upper left central crowned, imperfect root filling, slight thickening of peridental line at apex, indicating chronic pericementitis. The same condition is seen in connection with the lateral incisor which forms the anterior abutment of a bridge.

Fig. 63.—Upper right central, root canal filled to the apex, with a definite area of destruction at the apex. Upper left central, root filling passing through the apex. Dark area above is the nasal fossa.

Upper Anterior Region

Fig. 64.

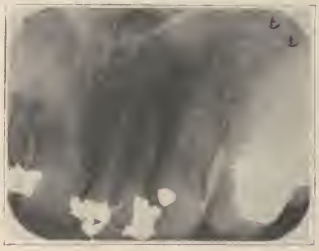


Fig. 65.

Fig. 64.—Upper right canine crowned with dummy attached and placed in space of right lateral. Right lateral root in position with granuloma at the apex. Chronic proliferative pericementitis apex upper right premolar.

Fig. 65.—Upper right central incisor with large apical opening and pulp chamber, due to arrested development probably from trauma; secondary infection and chronic rarefying osteitis with granuloma.

Fig. 66.

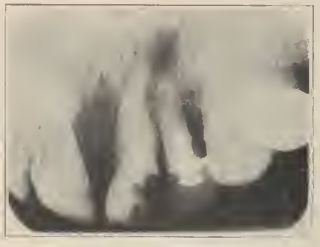


Fig. 67.

Fig. 66.—Upper left lateral incisor contains infected pulp, no root filling, and presents ill-defined periapical area due to chronic rarefying osteitis and suppuration. Canine normal.

Fig. 67.—Upper right central incisor shows extensive decay of crown, good root filling, no periapical disturbance. Lateral incisor crowned, perforation of distal side of root, with area of bone destruction at this point; also area of chronic rarefying osteitis and granuloma at apex.

Upper Anterior Region

Fig. 68.

Fig. 69.

Fig. 68.—Upper left central incisor, pulp vital, no periapical abnormality. Upper right central has good root filling but shows dark area above apex, due to chronic rarefying osteitis with granuloma. Lateral incisor has been lost; in this region also is found a dark area, due to rarefying osteitis remaining after extraction of tooth from failure to curette the tooth socket. The contents of this area are just as much of a menace as of the area connected with the central incisor.

Fig. 69.—Upper right lateral incisor gave no response to faradic test; pulp evidently died, causing chronic rarefying osteitis shown by large dark area.

Fig. 70.

Fig. 71.

Fig. 70.—Upper left central incisor crowned, root filling to apex, no evidence of periapical disease. Lateral incisor crowned, absorption of end of root, with large dark periapical area with ill-defined borders, probably containing granulation tissue; lateral perforation of root by post. Canine contains a vital pulp and presents no abnormality. Large dark area above is nasal fossa.

Fig. 71.—Upper right central crowned, no sign of root filling; small periapical dark area due to chronic rarefying osteitis and granuloma formation. Lateral incisor pulpless, peridental thickening at apex.

Upper Anterior Region

Fig. 72.

Fig. 73.

Fig. 72.—Upper right lateral incisor pulpless, no root filling, very large area of chronic rarefying osteitis; the ragged edges indicate probably a suppurative process. The area apparently extends to the apex of the central incisor, but the pulp of this tooth is still vital.

Fig. 73.—Upper right lateral incisor forms bridge abutment; no periapical disease shown, but there is loss of bony support due to pyorrhea. Canine shows perforation of side of root by post, and practically no root filling. First premolar crowned, no root fillings, chronic apical pericementitis shown by thickening of normal peridental dark line.

Fig. 74.

Fig. 75.

Fig. 74.—Extensive loss of the alveolar process region upper left premolar, canine and lateral. Granuloma apex upper left canine. Rarefied area between lateral and canine contains five pieces of cement. Lateral root was perforated and root supported a crown, each time crown was recemented the excess was pushed through the distal side of root.

Fig. 75.—Upper right central and lateral incisors normal. Canine, supporting bridge, shows large perforation of mesial side of root, with area of bone destruction probably containing granulation tissue extending over to lateral incisor. Apex of canine very close to floor of nasal chamber.

Upper Anterior Region

Fig. 76.

Fig. 77.

Fig. 76.—Apical portion of root of upper right central incisor left behind after extraction. The piece of root is surrounded by an area of chronic rarefying osteitis with granuloma.

Fig. 77.—Upper right central incisor showing fracture of root near apex. Injury producing fracture also caused death of pulp and chronic abscess with sinus.

Fig. 78.

Fig. 79.

Fig. 78.—Upper right central and lateral incisors, pulps vital, no periapical abnormality; there is marked bone destruction and loss of support of roots from crowns toward apices, due to chronic suppurative osteopericementitis (pyorrhea).

Fig. 79.—Upper right central and lateral incisors missing, being replaced by bridgework. A portion of hypodermic needle is shown at site of central. Canine and premolars show posts in roots, no other root fillings, and evidences of chronic apical pericementitis. Apex of second premolar is very close to maxillary sinus.

Upper Anterior Region

Fig. 80.

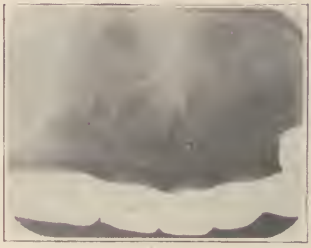


Fig. 81.

Fig. 80.—Upper right central incisor contains vital pulp, normal peridental line. Lateral incisor dead pulp, large area of bone destruction above apex, with well-defined outlines indicating cyst formation, extending up to floor of nose, making a thin partition at this point.

Fig. 81.—Upper incisor region covered by a bridge, all teeth having been lost. At site of left central incisor is a pear-shaped dark area due to presence of a cyst allowed to remain behind when this tooth was extracted years before; there were no clinical evidences of its presence. At operation the cavity contained thick pus.

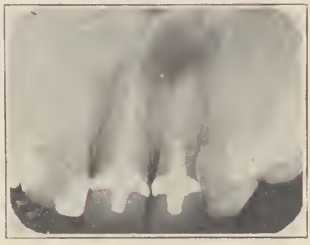


Fig. 82.

Fig. 83.

Fig. 82.—Upper right central crowned, good root filling, periapical conditions normal. Lateral incisor crowned, imperfect root filling, large periapical area extending to floor of nose, probably due to cyst formation and also containing some granulation tissue.

Fig. 83.—Upper right lateral incisor shows root filling passing through apex into large periapical area of chronic rarefying osteitis with ragged edges indicating a suppurative process. Pulp vital in central incisor, the apex of which extends to edge of area of disease.

Upper Anterior Region

Fig. 84.

Fig. 85.

Fig. 84.—Supernumerary tooth between roots of upper central incisors. Suture line is clearly shown.

Fig. 85.—Pulp in upper left lateral incisor devitalized by blow. The same trauma caused a transverse fracture of alveolar process just below apex of lateral incisor, but did not fracture root.

Fig. 86.

Fig. 87.

Fig. 86.—Upper right central and lateral incisors after pulps had been freshly devitalized with arsenic and root canals filled. Fillings are seen extending to apices. Area of disease connected with canine overlaps root of lateral but does not involve it.

Fig. 87.—Film of same teeth made one year later, showing absorption of both apices, with ends of root fillings extending into areas of destroyed bone, probably the result of action of arsenic.

Upper Anterior Region

Fig. 88.

Fig. 89.

Fig. 88.—Fracture of the apical third of roots of the upper right and left central incisors. Fractured portions lying over roots of the laterals; large areas of chronic rarefying osteitis with suppuration.

Fig. 89.—Fracture of the apical third of the upper right central root; diagnostic wire in canal down to the region of fracture. Upper left central canal not filled to the apex.

Fig. 90.

Fig. 91.

Fig. 90.—Resorption of the apical third of the upper left central root, showing a fracture of the root canal filling. Upper right central normal.

Fig. 91.—Fracture apical third of roots of right and left central incisors, no rarefying osteitis around apical region. Upper left lateral incisor crowned with a chronic proliferative pericementitis around the apical region.

Upper Anterior Region

Fig. 92-*A*.

Fig. 92-*B*.

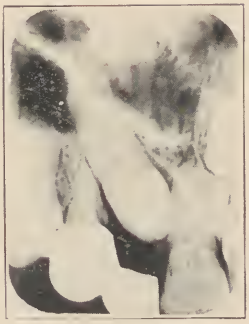


Fig. 93.

Fig. 92.—*(A)* Malformed upper right central incisor. Patient struck at the age of seven. *(B)* Photograph of right central after extraction showing its chair-like formation.

Fig. 93.—Upper left first premolar crowned with dummy attachment in the canine region. Upper left canine impacted, crown impinging on the root of the upper left central incisor; the left lateral is missing. Two supernumerary teeth lie on the palatal side directly above and behind the central incisors and in the median line.

Fig. 94-*A*

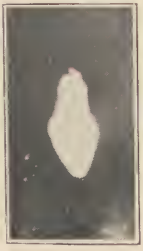


Fig. 94-*B*

Fig. 95.

Fig. 94.—*(A)* Supernumerary tooth lying above and behind the central incisors in the median line on the palatal side. *(B)* Supernumerary tooth after removal.

Fig. 95.—Supernumerary tooth lying on the palatal side, directly behind the upper left central. The tooth lies in a transverse position, the crown pointing toward the left lateral incisor.

Upper Anterior Region

Fig. 96.

Fig. 97.

Fig. 96.—Supernumerary tooth (only crown formed) lying high in the palate, crown pointing distally; root forming in such a position that it causes undue pressure on the anterior palatine nerve.

Fig. 97.—Radiographic examination of a child, showing the undevelopment of the roots of the permanent teeth; but most important, two supernumerary teeth lying, one on either side of the median line posterior to the upper central incisors.

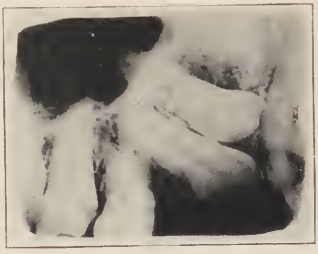


Fig. 98.

Fig. 98.—Impaction of the upper left canine and lateral incisor. Apical third of the canine curves upward and toward the median line. The root of the lateral extends straight back into the maxillary sinus. This is shown by the absence of the lamina dura about the apical third of the root.

Upper Anterior Region

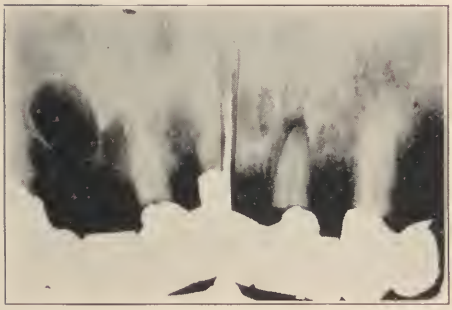


Fig. 99.

Fig. 102.

Fig. 99.—Cyst under bridge in the upper left canine region; upper left lateral shows carious condition under the crown. Upper right central shows carious condition under the crown, and chronic rarefying osteitis with granuloma; upper right canine shows carious condition under crown apex normal.

Fig. 102.—Cyst extending from the median line to the premolars, including the upper right central and lateral incisors, canine and first premolar, and extending posteriorly about 20 mm.

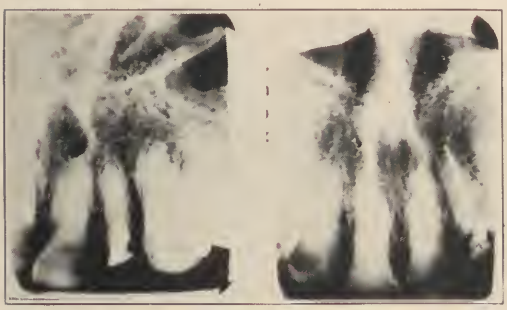


Fig. 100.

Fig. 101.

Fig. 100.—*(A)* Anterior palatine foramen showing as a dark area lying over the apex of the upper right central incisor. Upper right lateral, root canal not filled to the apex. *(B)* Same region as *(A)*, but taken at a different angle; the anterior palatine foramen now in its proper relationship to the upper central incisors. The upper right lateral incisor has been refilled and the root canal filling extends through the apex.

Fig. 101.—A barbed broach used as a diagnostic wire extending into the apical tissue a remarkable distance; patient did not complain of pain. Perforation of the root on the mesial side of first premolar.

Upper Right Region

Fig. 103.

Fig. 104.

Fig. 103.—Upper right side from canine to first molar inclusive; nothing abnormal.

Fig. 104.—Upper right canine normal. First premolar good root filling, apex extends close to floor of maxillary sinus. First molar roots apparently project into maxillary sinus, but in reality are in the wall of the sinus; furthermore, this tooth has a vital pulp.

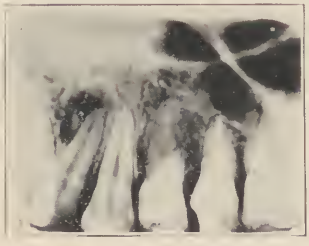


Fig. 105.

Fig. 106.

Fig. 105.—Upper right lateral; dark area at the apex about size of pea, is chronic rarefying osteitis with granuloma; upper right second premolar root canal filled.

Fig. 106.—Upper right first premolar canal filled. Upper right second premolar canal not filled to the apex. Chronic proliferative pericementitis causing a slight thickening of the peridental membrane about the tooth apex. Upper right first molar nonvital lingual root canal partially filled. The maxillary sinus dips down into the bifurcation of the roots of the first molar.

Upper Right Region

Fig. 107.

Fig. 108.

Fig. 107.—Upper right canine and first premolar normal. Second premolar pulpless, partial root filling, slight peridental thickening at apex. The dark space above the premolars is the maxillary sinus, separated from the roots of these teeth by a thin plate of bone.

Fig. 108.—Upper right canine and first premolar contain vital pulps. Second premolar and first molar show filled roots extending up to but not encroaching on maxillary sinus.

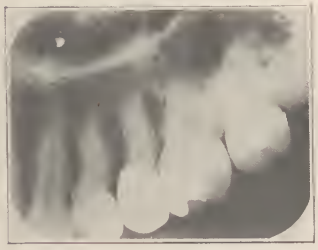


Fig. 109.

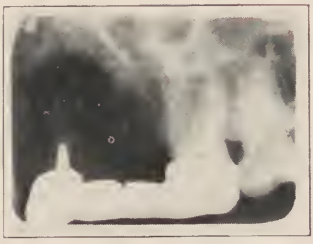


Fig. 110.

Fig. 109.—Relationship of roots of first and second molars to maxillary sinus shown; they project above the level of the floor, but do not encroach on cavity.

Fig. 110.—Showing complete loss of the first premolar root, (which was used as an abutment for a bridge), due to some infection causing resorption.

Upper Right Region

Fig. 111.

Fig. 112.

Fig. 111.—Normal relationship of roots of premolars and molars to maxillary sinus.

Fig. 112.—First molar pulpless, imperfect fillings in buccal roots; lingual root filled to apex; no periapical abnormalities, though roots apparently project into maxillary sinus.

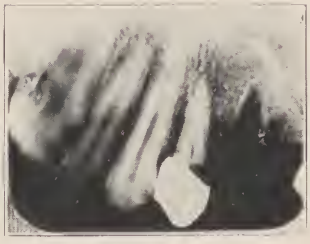


Fig. 113.

Fig. 114.

Fig. 113.—Upper right first premolar having gold crown with large carious condition under the crown on the distal side. Dark area posterior to first premolar is the socket of the second premolar.

Fig. 114.—First and second premolars pulpless, partial root fillings, no abnormal periapical conditions. First molar missing, and floor of maxillary sinus projects well down between second premolar and second molar.

Upper Right Region

Fig. 115.

Fig. 116.

Fig. 115.—First and second premolars, roots not fully calcified. Perforation disto-buccal root, canals filled, filling in the disto-buccal root extending into the surrounding tissue.

Fig. 116.—Caries in the coronal third of the first and second premolars and both having chronic rarefying osteitis with granuloma. Seen in the radiogram as the large dark areas around the apical region.

Note.—Figures 115 and 116 show the difference between the normal and abnormal condition to be found around the apical region and should be studied carefully. Failure to diagnose the condition shown in Fig. 115, i.e., roots not fully calcified will cause much damage.

Fig. 117.

Fig. 117.—Second premolar crowned, partial root filling; dark periapical area with irregular outline, denoting chronic rarefying osteitis with suppuration.

Upper Right Region

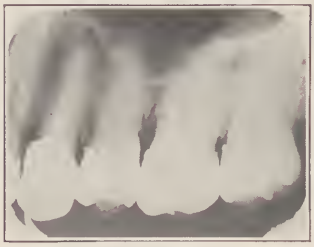


Fig. 118.

Fig. 118.—First premolar crowned, imperfect root fillings, periapical rarefaction, probably with suppuration. First molar pulpless, probably chronic rarefying osteitis with granuloma at apex of lingual root.

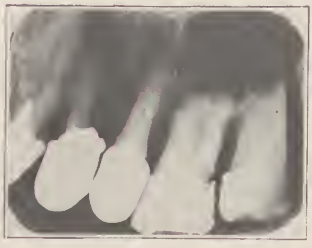


Fig. 119.

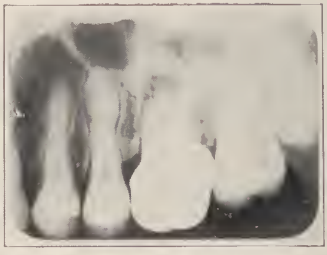


Fig. 120.

Fig. 119.—Canine, premolars and molars show absent or imperfect root fillings, badly fitting crowns, and overhanging edges of fillings. First premolar, large area of periapical bone destruction, probably suppuration, and erosion of cementum.

Fig. 120.—Hypercementosis apical third, second premolar pulp apparently vital; First molar shows poorly fitting crown and chronic rarefying osteitis with granuloma. No root canal filling.

Upper Right Region

Fig. 121.

Fig. 122.

Fig. 121.—The partition of bone between the second molar and the maxillary sinus has been destroyed by periapical disease, producing a direct communication of this tooth with the maxillary sinus and secondary infection of that cavity. The second premolar, although containing a partial root filling, and presenting some periapical thickening, is separated from the antrum by a bony partition. The apices of the canine and first premolar show nothing abnormal, but lie very close to the floor of the sinus.

Fig. 122.—Second premolar crowned, partial root filling, periapical region normal. First molar crowned, imperfect root fillings, erosion of cementum and large periapical area of chronic rarefying osteitis with suppuration and granuloma. Note floor of maxillary sinus just above this area.

Fig. 123.

Fig. 123.—First premolar crowned, practically no root filling, small periapical area of chronic rarefying osteitis with granuloma. Second premolar normal. Part of first molar root extending into maxillary sinus.

Upper Right Region

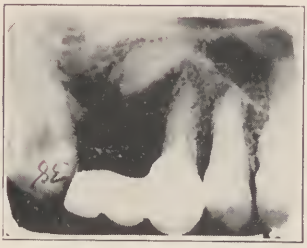


Fig. 124.

Fig. 125.

Fig. 124.—Apical third of the upper right canine lying above the first premolar. The canine was impacted and was broken during extraction, a portion being allowed to remain. Patient aged 38.

Fig. 125.—Upper right second premolar crowned, partial root filling; periapical granuloma. Considerable thickness of bone between the diseased area and the maxillary sinus.

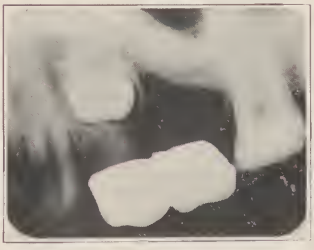


Fig. 126.

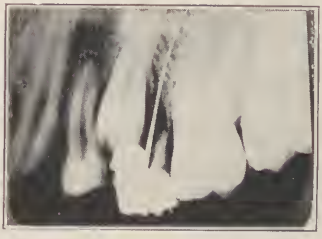


Fig. 127.

Fig. 126.—Impacted upper right premolar lying on the lingual side and over the first premolar.

Fig. 127.—Deciduous second molar in position roots resorbed but diagnostic wire placed in what was thought to be the canals. Radiogram shows the second premolar lying directly under the deciduous molar.

Upper Right Region

Fig. 128.

Fig. 129.

Fig. 128.—Upper right first premolar forms abutment of bridge; transverse fracture of root at junction of upper and middle thirds.

Fig. 129.—Large lateral area of bone destruction in region of upper right canine. Second premolar crowned, imperfect root filling, apical region normal. Dark area over first molar is due to a recess in the maxillary sinus. First molar has a vital pulp and no abnormality about roots.

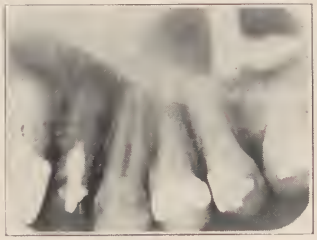


Fig. 130.

Fig. 130.—Upper right lateral crowned, no root canal filling except the post of the crown. Large white right angle area in the upper right hand corner is the shadow of the frame of the patient's eye glass, in this particular case superimposed over the shadow of the antrum, thus having the appearance of a foreign body in the antrum.

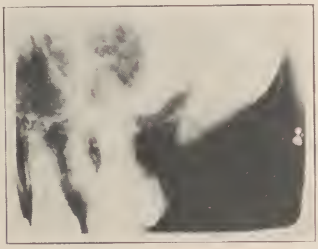


Fig. 131.

Fig. 132.

Fig. 131.—Impacted upper right third molar, crown pointing posteriorly and upward.

Fig. 132.—Impacted upper second premolar, coronal portion lying between the roots of the first premolar and first molar. Resorption of the lingual root of the first molar has taken place and root filling material extends into the surrounding tissue.

Upper Left Region

Fig. 133.

Fig. 134.

Fig. 133.—Upper left teeth from central incisor to second premolar, pulps vital, periapical conditions normal. Destruction of bony septum between lateral incisor and canine due to pyorrhea. Apex of second premolar near floor of maxillary sinus.

Fig. 134.—Chronic rarefying osteitis with suppuration between the canine and first premolar, originating from the canine. The canine is nonvital, having just a slight semblance of some root filling material in the canal. Large overhanging fillings in the canine, first, and second premolars.

Fig. 135.

Fig. 136.

Fig. 135.—Roots of upper left teeth from central incisor to second premolar, all normal.

Fig. 136.—Maxillary sinus extends well forward over apex of canine. No abnormal periapical conditions.

Upper Left Region

Fig. 137.

Fig. 137.—Upper left second premolar root not fully calcified, tooth not fully erupted.

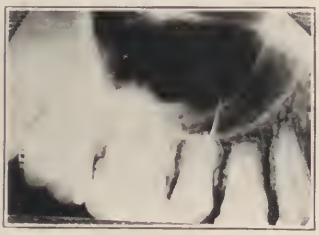


Fig. 138.

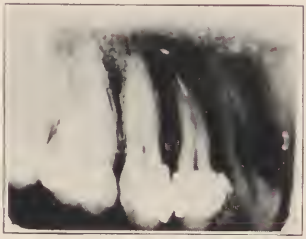


Fig. 139.

Fig. 138.—Two diagnostic wires passing through the apex of the second premolar into the antrum or maxillary sinus, the maxillary sinus extending forward to the canine region. The lingual root of the first molar is not in the antrum but lying in its wall.

Fig. 139.—Diagnostic wire broken off in the apical third of the first premolar. Overhanging filling in the second premolar.

Fig. 140.

Fig. 141.

Fig. 140.—First molar has large filling on distal aspect. Outline of disto-buccal root is indistinctly shown above this. Bone destruction around filling causes a pocket.

Fig. 141.—Upper left premolars, pulps vital, periapical regions normal. Circumscribed dark area about apex of second premolar somewhat resembling an area due to rarefying osteitis is only due to a recess in the maxillary sinus; the normal line of bone can be traced completely around the apex of this tooth. Light shadow in upper left corner is due to malar bone.

Upper Left Region

Fig. 142.

Fig. 143.

Fig. 142.—Upper left second premolar pulpless, no root canal filling; thickening of peridental membrane due to inflammation about apex, which is very close to floor of maxillary sinus.

Fig. 143.—Upper left canine, root filling only extends about half way, apex apparently encapsulated with healthy bone. First premolar crowned. The film is overexposed, but shows that the root of this tooth is absorbed and surrounded by area of bone destruction with granuloma. Second premolar crowned, partial root filling, with apex involved in a common area of bone destruction and granuloma with mesiobuccal root of first molar which contains no root filling.

Fig. 144.

Fig. 145.

Fig. 144.—Upper left premolars and molars have poorly fitting crowns, responsible for gingival infection and absorption of bone around necks of teeth. First premolar shows no root filling and peridental thickening. Second premolar, partial root filling, periapical bone destruction and granuloma. Same condition of first molar. Second molar, probably no periapical disease, but buccal roots denuded from pyorrhea.

Fig. 145.—Upper left first premolar crowned, no root filling, post of crown perforating side of root; about site of perforation is an area of chronic rarefying osteitis with granuloma; periapical thickening of peridental membrane.

Upper Left Region

Fig. 146.

Fig. 147.

Fig. 146.—Upper left first premolar, decay under filling. Second premolar crowned, imperfect root filling, which, however, extends to apex, periapical region normal. First molar pulpless, apparent area of rarefaction about apex of lingual root, but close scrutiny reveals cancellated bone in this position. A bony prominence over this tooth projects into maxillary sinus.

Fig. 147.—First premolar shows fracture of root at junction of upper and middle thirds; pulp of this tooth remained vital for several years after fracture.

Fig. 148.

Fig. 149.

Fig. 148.—Upper left maxillary sinus extends forward to canine, which is normal. First premolar crowned, periapical thickening of peridental membrane due to chronic proliferative pericementitis. Second premolar vital pulp, apex normal, though extending to floor of maxillary sinus. First molar crowned, periapical area of bone destruction about lingual root, in wall of maxillary sinus.

Fig. 149.—Apex of second premolar insufficiently shown for diagnosis. First molar crowned, imperfect root fillings, chronic periapical rarefying osteitis with granuloma, extending to floor of maxillary sinus.

Upper Left Region

Fig. 150.

Fig. 151.

Fig. 150.—Large sharply defined area of bone destruction above premolars and first molar. Probably cyst formation arising in connection with first molar, whose roots are seen to be eroded. The cyst cavity probably encroaches on the maxillary sinus, which is seen above the second molar.

Fig. 151.—First premolar crowned, partial root filling, apex probably normal. Second premolar crowned, partial root fillings, apex probably normal. First molar shows a large area of bone destruction about apex of lingual root. Absence of root fillings would indicate presence of dead pulp. Destruction of bone septum between first and second molars due to pyorrhea from overhanging edge of filling.

Fig. 152.

Fig. 153.

Fig. 152.—Condition about premolars is ill-defined, owing to overexposure of film. First molar crowned, imperfect root fillings. Apex of lingual root is seen in wall of maxillary sinus surrounded by an area of bone destruction which probably communicates with the sinus. The bony septum between the two molars is destroyed by pyorrhea except its apical third. Practically no bony attachment to second molar.

Fig. 153.—First premolar pulpless, poor root filling, periapical thickening of peridental membrane due to chronic proliferative pericementitis. Apex very close to maxillary sinus. Large area of bone destruction with granuloma about apices of last molar.

Upper Left Region

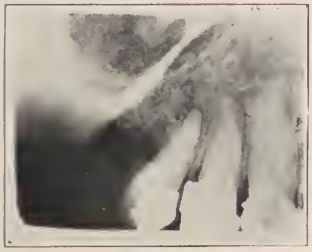


Fig. 154.

Fig. 155.

Fig. 154.—Upper left second premolar chronic rarefying osteitis with granuloma. Overhanging filling first premolar. Light line running diagonally in the molar region is the shadow of the malar bone.

Fig. 155.—Upper left second molar forms posterior abutment of bridge. Bone completely destroyed around buccal roots.

Fig. 156.

Fig. 157.

Fig. 156.—First premolar, perforation of side of root with large area of bone destruction surrounding the perforation; apex normal.

Fig. 157.—Apical region of crowned premolars normal. First molar missing. Deep pocket due to pyorrhea just in front of second molar.

Upper Left Region

Fig. 158.

Fig. 159.

Fig. 158.—Decay beginning on mesial surface of upper left canine near cervical margin. First premolar crowned, two roots, apparently good root fillings, large, irregular, clearly defined periapical area of chronic rarefying osteitis with granuloma. Second premolar normal.

Fig. 159.—First molar, pulp probably vital; extensive pyorrheal bone destruction, extending between roots. Second molar, badly fitting crown, poor root fillings, but apical region normal.

Fig. 160.

Fig. 161.

Fig. 160.—Upper left canine and first premolar normal. Impacted first molar, surrounded by an area of bone destruction involving apex of second premolar.

Fig. 161.—Upper left canine pulpless, apparently good root filling, considerable periapical area of bone destruction with granuloma. Dark area to left is maxillary sinus.

Upper Left Region

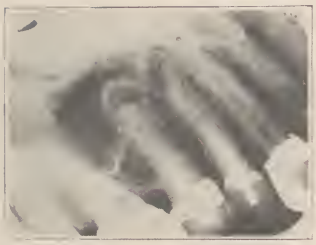


Fig. 162.

Fig. 163.

Fig. 162.—First premolar crowned, no root filling, marked curvature of root, apex normal. Second premolar crowned, partial root filling, periapical chronic rarefying osteitis with granuloma. This area forms a projection which is walled off from the maxillary sinus by a thin plate of bone.

Fig. 163.—Upper left first premolar crowned, imperfect root filling, no periapical abnormality. Second premolar, poorly fitting crown, leading to infection and absorption of alveolar septum; apparently good root filling; periapical bone destruction, granuloma, and roughening of apex.

Fig. 164.

Fig. 165.

Fig. 164.—Second premolar crowned, with decay shown under edge of crown; no root filling, canal probably contains necrotic pulp tissue; chronic rarefying osteitis with granuloma about apex, which projects above floor of maxillary sinus, but is separated from it by a thin plate of bone. White line extending vertically upward from apex indicates a septum in maxillary sinus.

Fig. 165.—Upper left second premolar, death of pulp under filling. Ill-defined periapical area of bone destruction indicating suppuration.

Upper Left Region

Fig. 166.

Fig. 167.

Fig. 166.—Second premolar, bridge abutment, nothing abnormal seen at apex. First molar, death of pulp beneath filling; area of bone destruction about apex of palatal root, well above floor of maxillary sinus.

Fig. 167.—Another view of first molar shown in opposite illustration.

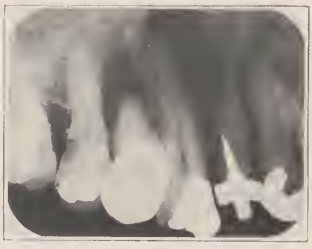


Fig. 168.

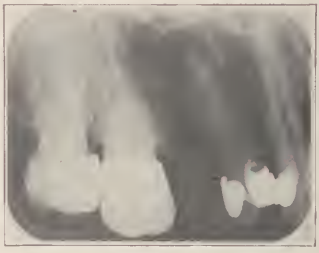


Fig. 169.

Fig. 168.—Upper left lateral incisor crowned, post does not follow root canal, but passes to side of root, no root filling, apical region apparently normal. Canine, large filling extending to pulp chamber, no root filling, root canal evidently contains infected pulp tissue; large area of chronic rarefying osteitis with granuloma around apex of this tooth and extending almost down to neck on mesial side. First premolar crowned, extensive root absorption and chronic periapical rarefying osteitis with granuloma, extending to root of second premolar. Second premolar, decay on distal surface; above this is a partial loss of alveolar septum due to pyorrhea.

Fig. 169.—First premolar pulpless, no root filling, apex involved in large area of chronic rarefying osteitis with granuloma extending to region of second premolar, which has been lost.

Upper Left Region

Fig. 170.

Fig. 171.

Fig. 170.—Large area of chronic rarefying osteitis with clearly defined walls indicating cyst formation. This has probably arisen from infection connected with the first premolar, which is crowned, and contains an imperfect root filling.

Fig. 171.—Same case as in opposite film, following extraction of first premolar and curettement of cyst cavity. Taken six weeks later; regeneration of bone is taking place, as indicated by haziness of outline of cavity, and lessening in size of rarefied area.

Fig. 172.

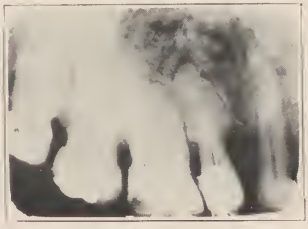


Fig. 173.

Fig. 172.—Large area of bone destruction in region between upper left second premolar and first molar; irregular margins indicating chronic rarefying osteitis with suppuration. Permanent canine and second molar unerupted. Infection probably arose in connection with deciduous molar.

Fig. 173.—Hypercementosis apical region upper left second premolar. Diagnostic wire in canal. Destruction of the alveolar process from the canine to the third molar.

Upper Left Region

Fig. 174.—Upper left second premolar impacted and lying on the lingual side. The upper third molar is also impacted.

Fig. 175.

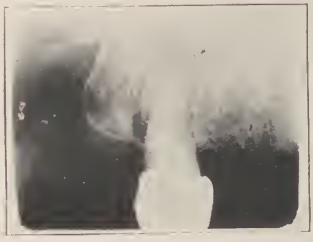
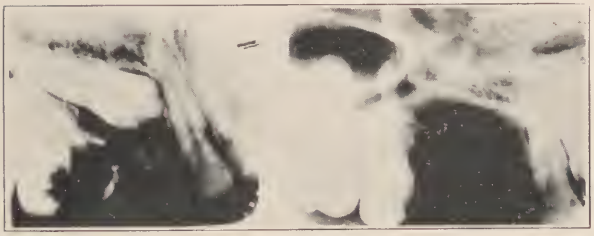


Fig. 176.

Fig. 175.—Maxillary sinus extending to the border of the alveolar process in the region of the first molar, which is missing.

Fig. 176.—Showing three important land marks: The hamular process of the sphenoid bone, in the upper left hand corner; the tuberosity of the superior maxilla in the middle; and the coronoid procers of the ramus of the mandible.

Upper Left Region

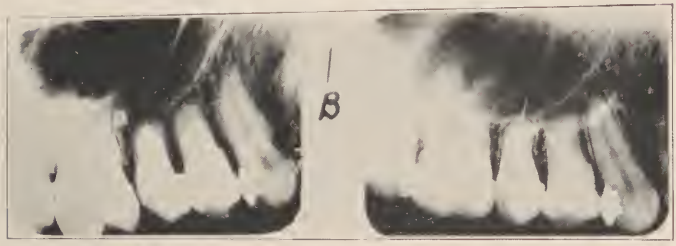


A. *B.*

Fig. 177.

A. *B.*

Fig. 178.



A. *B.*

Fig. 179.

Fig. 177.—(*A*) Impacted canine with a hooked root. (*B*) Same case after removal of the canine, showing the outline of the tooth.

Fig. 178.—(*A*) Chronic rarefying osteitis with cyst formation. (*B*) Same case taken at a different angle showing the shadow of the dense malar bone.

Fig. 179.—(*C*) File broken off in the apical third of the second premolar. (*B*) Piece of file after being removed from the root. (*A*) Case after removal. Root having been filled after the file had been removed, the operation being similar to that of root amputation.

Upper Left Region

Fig. 180.—(*A*) Root of the upper left first molar lying in the antrum just anterior to the lingual root of the second molar. An attempt was made to remove the root through the socket of the first molar with the following result. (*B*) Root a little posterior to the position shown in (*A*). (*C*) Shows the root now lying above the roots of the third molar.

Upper Left Region

Fig. 181.

Fig. 182.

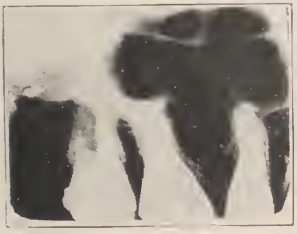


Fig. 183.

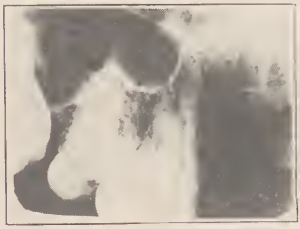


Fig. 184.

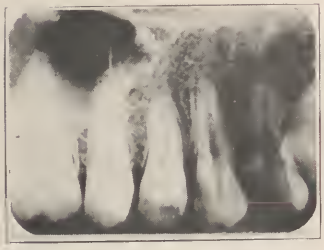


Fig. 185-A.

Fig. 185-B.

Fig. 185-C.

Fig. 181.—First premolar has been extracted, showing the socket and a chronic rarefying osteitis with cyst formation. Diagnostic wires in the second premolar, and the sharp white line extending into the maxillary sinus is a shadow cast by a septum in the floor of the maxillary sinus.

Fig. 182.—Diagnostic wires in the first premolar. Septum in the floor of the maxillary sinus extending from the apex of the second premolar to the edge of the film. If diagnostic wire should be placed in the second premolar it would appear as if the wire extended into the maxillary sinus.

Fig. 183.—Different view of septum of the maxillary sinus having the appearance of the root of the second premolar in the sinus.

Fig. 184.—Same as Fig. 183 except taken at a different angle showing the septum moved to the right.

Fig. 185.—(*A*) Diagnostic wire lost in canal and extending through a perforation of the root into the maxillary sinus. (*B*) and (*C*) two views of the tooth after extraction, showing the perforated root and the exact length of the wire which had passed through into the sinus.

Lower Anterior Region

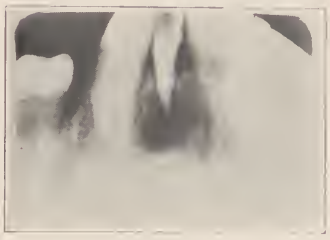


Fig. 186.

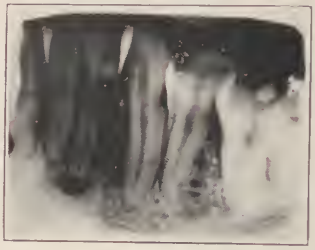


Fig. 187.

Fig. 186.—Chronic rarefying osteitis with suppuration, lower left lateral, resorption of the root forming a very sharp point.

Fig. 187.—Chronic proliferative pericementitis apical region of the lower right lateral. Caries middle third root of the right canine with a chronic rarefying osteitis with cyst formation apical region.

Fig. 188.

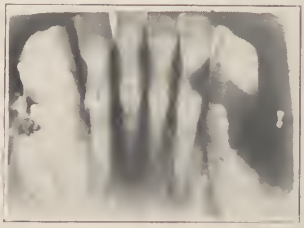


Fig. 189.

Fig. 188.—Lower right central and lateral incisors in center of film; pulps vital, bone normal.

Fig. 189.—Calcareous deposits middle third all anterior teeth shown as a fullness on the root. Chronic rarefying osteitis with cyst formation lower left central. Caries in the coronal third of the lower right lateral and canine. Chronic rarefying osteitis with granuloma apical region of the right lateral incisor.

Lower Anterior Region

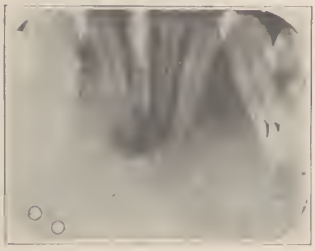


Fig. 190.

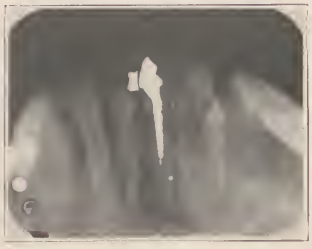


Fig. 191.

Fig. 190.—Area of chronic rarefying osteitis with granuloma about apices of lower right central and lower left central and lateral incisors. It is difficult to tell which of these teeth is responsible as all contain dead pulps.

Fig. 191.—Lower right central incisor pulpless, partial root filling, periapical area of chronic rarefying osteitis with granuloma.

Fig. 192.

Fig. 193.

Fig. 192.—Dead pulp in lower left lateral incisor. Periapical area of chronic rarefying osteitis with suppuration.

Fig. 193.—Lower left lateral incisor pulpless; root filling extends through apex into previously existing bone cavity due to chronic rarefying osteitis.

Lower Anterior Region

Fig. 194.

Fig. 195.

Fig. 194.—Dead pulp in lower right central incisor; periapical area of chronic rarefying osteitis with granuloma.

Fig. 195.—Large area of bone destruction with sharply defined edges due to cyst involving roots of lower right central and lateral and left central incisors. Left lateral incisor missing. Pulps dead in central incisors, but vital in right lateral and left canine. Cyst probably followed chronic rarefying osteitis in connection with death of the pulp of one of the central incisors. (Case referred by Dr. J. S. Evans.)

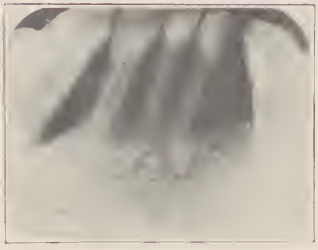


Fig. 196.

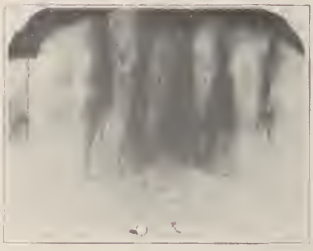


Fig. 197.

Fig. 196.—Lower right central and left central and lateral incisors, showing extensive destruction of bony septa between teeth from chronic suppurative pericementitis (pyorrhea). Right lateral incisor has already been lost from this cause.

Fig. 197.—Lower front teeth. Moderate destruction of alveolar septa due to chronic suppurative pericementitis. In the case of the right central incisor the infection extends completely around the apex of the root as shown by the thickened peridental line.

Lower Anterior Region

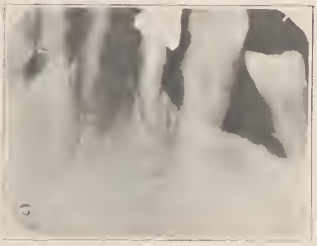


Fig. 198.—Extensive destruction of alveolar process following pyorrhea. Right canine shows roughening of root due to deposit of calculus. Right lateral incisor, ill-fitting crown, partial root filling, apical region normal. Right central incisor and first premolar missing.

Lower Right Region

Fig. 199.

Fig. 200.

Fig. 199.—Lower right canine normal; first premolar normal; second premolar pulpless, imperfect root filling, periapical thickening of peridental membrane. Between and below apices of premolars is seen a dark area due to mental foramen.

Fig. 200.—Lower right premolar and molar region. No bony abnormalities. Partial root fillings in first and second molars.

Lower Right Region

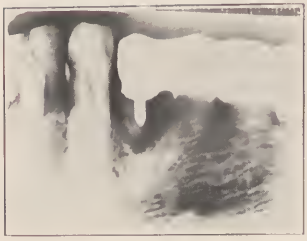


Fig. 201.

Fig. 202.

Fig. 201.—Lower right first premolar completely resorbed, having been used as a bridge abutment; the post of the abutment now extends into the soft tissue.

Fig. 202.—Lower right canine, caries of distal surface of crown. First and second premolars crowned, partial root fillings, periapical chronic rarefying osteitis and granuloma.

Fig. 203.

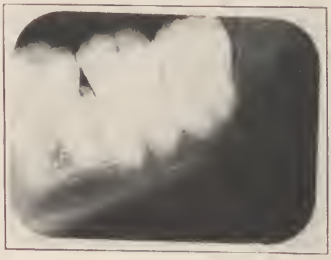


Fig. 204.

Fig. 203.—Lower right first premolar, pulpless, apparently good root filling, no periapical abnormality. Second premolar recently removed. Inferior dental canal seen curving up to mental foramen near socket of this tooth. First molar, large filling and caries of crown. No abnormality of bone.

Fig. 204.—Lower right third molar roots impinging on the mandibular canal causing pressure on the nerve. Patient suffered intense neuralgic pains, which ceased upon the extraction of the third molar.

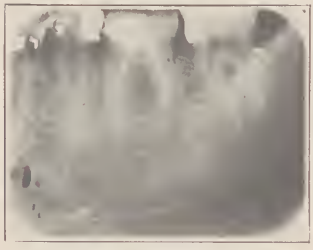


Fig. 205.

Fig. 206.

Fig. 205.—Lower right second premolar, caries beneath lower edge of filling, no periapical abnormality. First molar pulpless, partial root fillings, periapical thickening of pericementum about both apices. Mandibular canal indicated by two sharp parallel lines with dark space between, beneath roots of molars.

Fig. 206.—Second premolar, mesial side of crown broken away. First molar, broken down filling, partial root fillings, periapical thickening of pericementitis. Second molar pulpless, no root fillings, ill-defined periapical area due to chronic rarefying osteitis with suppuration. Small piece of root of third molar is seen. Diagonal light lines in lower corners are due to bending of film.

Lower Right Region

Fig. 207.

Fig. 208.

Fig. 207.—Lower right first premolar forms bridge abutment, partial root filling, periapical region normal; bone absorption around neck of tooth due to pyorrhea. Second premolar forms bridge abutment, pulp probably vital, periapical region normal. First and second molars missing.

Fig. 208.—Child fourteen years of age. First and second premolars, pulps vital. Incomplete calcification of apices. First molar pulpless, crown badly broken down, imperfect root fillings, apices imperfectly calcified.

Fig. 209.

Fig. 210.

Fig. 209.—Lower right second premolar partially impacted against first premolar. Pulps vital in all teeth. No bony abnormalities.

Fig. 210.—Second premolar, poorly fitting crown, partial root filling, periapical region normal. First molar pulpless, imperfect root fillings, peridental thickening at apices, and condensation of bone around distal apex. Broken down roots of second molar, with periapical thickening.

Lower Right Region

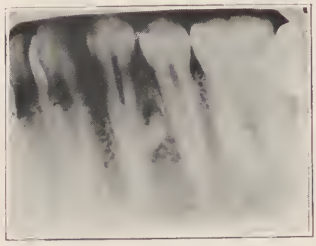


Fig. 211.

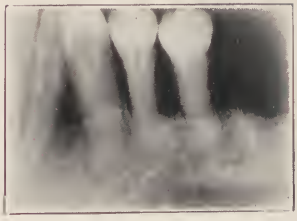


Fig. 212.

Fig. 211.—Small piece of root of the deciduous molar, lying between the roots of the first and second premolar.

Fig. 212.—Chronic suppurative pericementitis or pyorrhea depriving the canine and premolar teeth of over one-third of their support.

Fig. 213.—Root canal of the lower right second premolar not completely filled. Chronic rarefying osteitis with suppuration lower right first molar, which has an artificial crown and no root canal fillings.

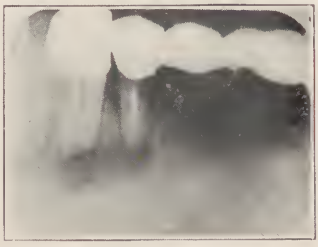


Fig. 214.

Fig. 215.

Fig. 214.—Chronic rarefying osteitis with suppuration, lower right canine and first premolar. Resorption apical third of the canine, no root canal filling. Caries under the crown of the first premolar. Root canal partially filled.

Fig. 215.—Chronic rarefying osteitis with granuloma apical region canine and first premolar, no root canal fillings except the posts of the crowns.

Lower Left Region

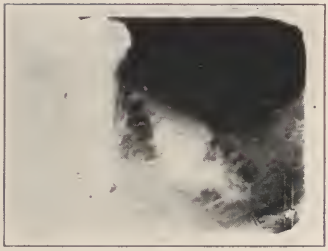


Fig. 216.

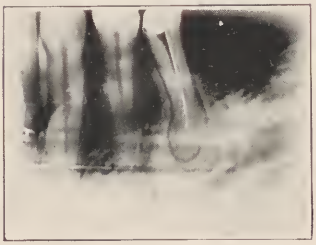


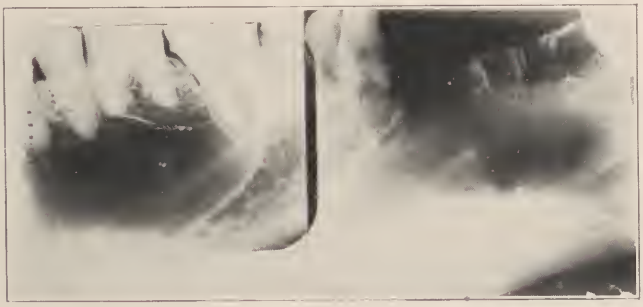
Fig. 217.

Fig. 216.—Apical third root of the lower right molar surrounded by a condensing osteitis.

Fig. 217.—Hypercementosis apical region lower right second premolar, diagnostic wire in the root canal passing down to the normal apex.

A. Fig. 218. *B.*

Fig. 218.—*(A)* Impacted lower right third molar lying horizontally. After removal patient suffered severe pain. *(B)* Showing the cause of pain to be small pieces of the alveolar process in the socket causing an irritation; upon removal the patient rested easier. (Case Dr. John Gunter.)



A. Fig. 219. *B.*

Fig. 219.—*(A)* Cyst in the region of the lower right canine to the second molar and extending almost to the lower border of the mandible. Teeth were extracted. *(B)* Showing case after extraction. The removal of teeth in such a case is not sufficient to warrant a cure. A Partsh operation must be performed or the removal of the entire epithelial lining. (Case Dr. John Gunter.)

Fig. 220.

Fig. 221.

Fig. 220.—Lower left first and second premolars, pulps vital. Between these teeth is seen a dense, well-defined mass, that might be mistaken for a piece of root were it not that all teeth are in place. This shadow is due to a subperiosteal bony nodule on lingual aspect of alveolar ridge, of no pathological significance. Beneath this is seen the mental foramen. First molar crowned, partial root fillings, no periapical abnormality.

Fig. 221.—Caries lower left molar causing complete separation of the distal root from the body of the tooth.

Fig. 222.

Fig. 223.

Fig. 222.—Lower left canine crowned, partial root filling, peridental thickening at apex; post of crown perforates side of root; about the perforation is an area of chronic rarefying osteitis with granuloma. First premolar crowned, partial root filling, periapical thickening of pericementum. Second premolar crowned, partial root filling, no periapical abnormality shown. First molar too distorted for interpretation.

Fig. 223.—Lower left, first molar missing. Second molar shows caries under distal portion of filling, extending to pulp chamber; large ill-defined periapical area of chronic rarefying osteitis with suppuration. Second molar crowned, partial root fillings, no periapical disease evident.

Fig. 224.

Fig. 225.

Fig. 224.—Lower left first molar, caries of distal side, not quite extending to pulp chamber; no periapical abnormalities.

Fig. 225.—Child, fourteen years of age. First and second premolars, pulps vital, incomplete calcification of apices. First molar pulpless, partial root fillings; this tooth and also the second molar show incomplete calcification of roots. Unerupted third molar is shown.

Lower Left Region

Fig. 226.

Fig. 227.

Fig. 226.—Lower left, broken down roots of first molar with peridental thickening. Second molar pulpless, partial root fillings, apical ends of roots hypercementosed; ill-defined periapical area, denoting suppuration.

Fig. 227.—Lower left first molar missing. Second molar pulpless, good root filling, extending into previously existing cavity in bone resulting from chronic rarefying osteitis; thickening of peridental membrane about anterior root. Third molar pulpless, good root fillings, extending slightly through apices; periapical region probably normal.

Fig. 228.

Fig. 229.

Fig. 228.—Lower left second molar, pulp vital, periapical region normal. Third molar, broken-down roots. Inferior dental canal is seen some distance beneath the roots of these teeth.

Fig. 229.—Lower left first molar pulpless, partial root fillings, periapical thickening of pericementum, with some root absorption. Third molar partially erupted, with occlusal surface partly covered by bone.

Lower Left Region

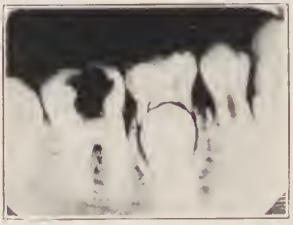


Fig. 230.—Caries coronal third lower left first molar. Deciduous second molar in position with the second premolar lying directly under, with the root not fully calcified.

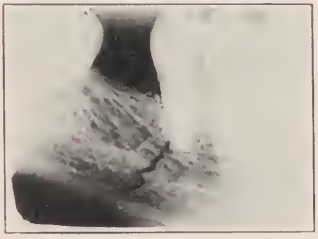


Fig. 231.

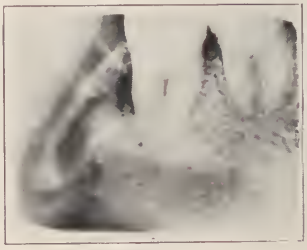


Fig. 232.

Fig. 231.—Green stick fracture, region of the lower left second premolar, shown in the radiogram as a dark line running from the apex of the root of the second premolar to the lower border of the mandible.

Fig. 232.—Fracture region of the lower left third molar, showing large sequestrum in the line of fracture.

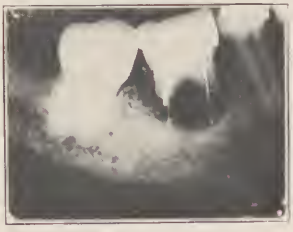


Fig. 233.

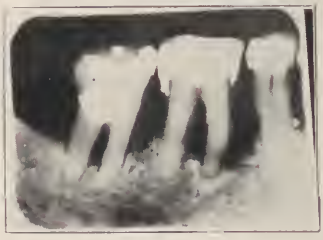


Fig. 234.

Fig. 233.—Chronic rarefying osteitis with cyst formation, showing a resorption of the apical third of the roots, also diagnostic wires extending through the apex and into the tissue. Lower left second molar has an artificial crown and probably vital pulp, as there is no disturbance in the apical region.

Fig. 234.—Chronic suppurative pericementitis, region of the lower left molars, showing loss of the alveolar process down to the apical third of the roots.

Lower Left Region

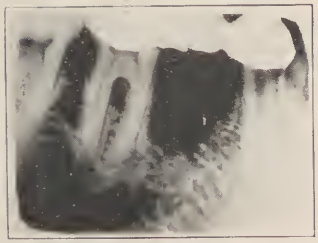


Fig. 235.

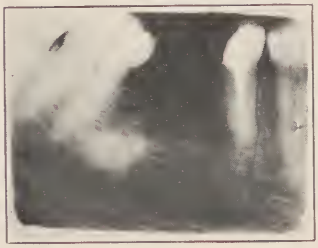


Fig. 236.

Fig. 235.—Foreign body, lying in the tissue in the region of the lower first molar. Shown in the radiogram as a dense white object—probably a piece of cement from the bridge which entered the socket of the first molar after a recent extraction.

Fig. 236.—Pulp stones, lower left second molar. Condensing osteitis, region of the lower left first molar, which is missing. Lower left second premolar, apical third of the root canal not filled. Pulp stones in the lower left first premolar.

Fig. 237.

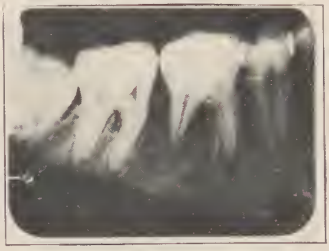


Fig. 238.

Fig. 237.—Caries under filling, distal wall of the lower third molar. Poorly fitting crown, lower left second molar. Caries distal wall, lower left second premolar, apical two-thirds of the root not filled. Condensing osteitis, apical region of the lower second premolar.

Fig. 238.—Diagnostic wire in distal root of the second molar and a broken wire in the middle third of the mesial root. Chronic proliferative pericementitis apical region, mesial root of the first molar, and resorption of the apical third of the distal root.

Lower Left Region

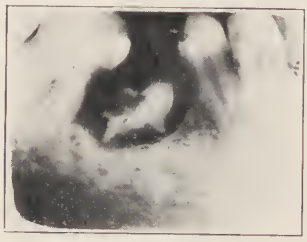


Fig. 239.

Fig. 240.

Fig. 239.—Deciduous second molar impacted, caries on the distal wall, and the roots resorbed. The second premolar is missing

Fig. 240.—Lower left second premolar impacted lying horizontally in the mandible. The crown impinging upon the root of the first premolar and the root running distally, taking a decided turn upward, in the apical region, toward the upper border of the mandible.

Fig. 241.

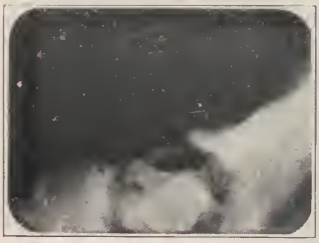
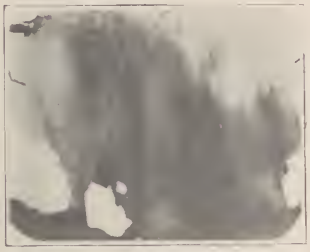


Fig. 242.

Fig. 241.—Complete impaction of the lower left third molar lying at an angle of 45 degrees, surrounded by a large rarefied area. This is a follicular or dentigerous cyst.

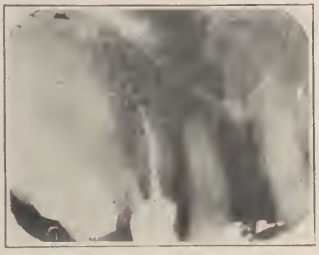
Fig. 242.—Composite odontome in the region of the lower left second molar, it being a mass of cementum and dentine irregular in formation.

Illustrating the Use of the X-Ray as a Check on Root Canal Treatment



A.

B.



C.

Fig. 243.—*A*. Upper left lateral incisor, dead pulp, with slight peridental thickening. *B*. Same tooth after opening, cleansing, and steril'zing of root canal, showing diagnostic wire in place, extending to apex. *C*. After completion of operation, showing root filling extending to apex.

A.

B.

C.

Fig 244.—*A*. Upper left second premolar crowned, partial root filling, periapical area of chronic rarefying osteitis with granuloma. *B*. Same tooth, showing crown removed, and diagnostic wire in place after opening and sterilizing root canal. *C*. Treatment completed, showing filling extending through apex into space produced by chronic rarefying osteitis.

Illustrating the Use of the X-Ray as a Check on Root Canal Treatment

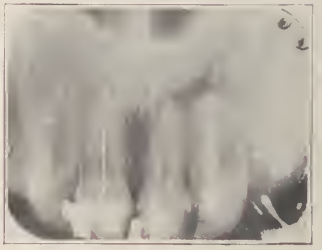
A.

B.

C.

Fig. 245.—*A*. Lower right first molar, partial root fillings, slight peridental thickening about apex of anterior root. *B*. Root fillings removed, canals sterilized, diagnostic wires in place. *C*. Completed operation, showing root canals filled to apices.

A.

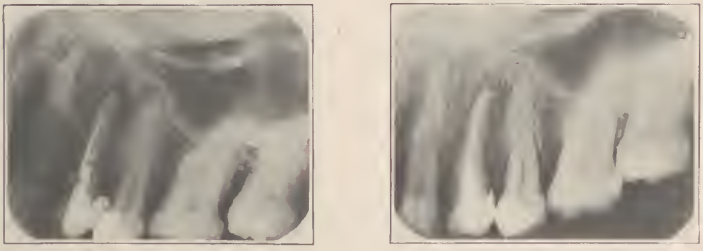


B.

C.

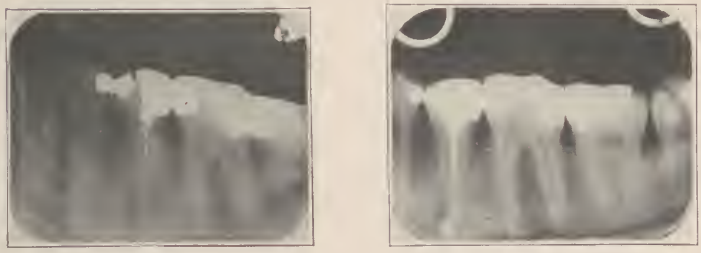
Fig. 246.—*A*. Upper right and left central and left central incisors, imperfect root fillings, periapical areas of chronic rarefying osteitis with granuloma. *B*. Central incisors have been opened, root fillings removed, and diagnostic wires placed in position. Right lateral incisor, new root filling and apical resection. *C*. Central incisors, after new root fillings passing through apices.

Illustrating the Use of the X-Ray as a Check on Root Canal Treatment



A. *B.*

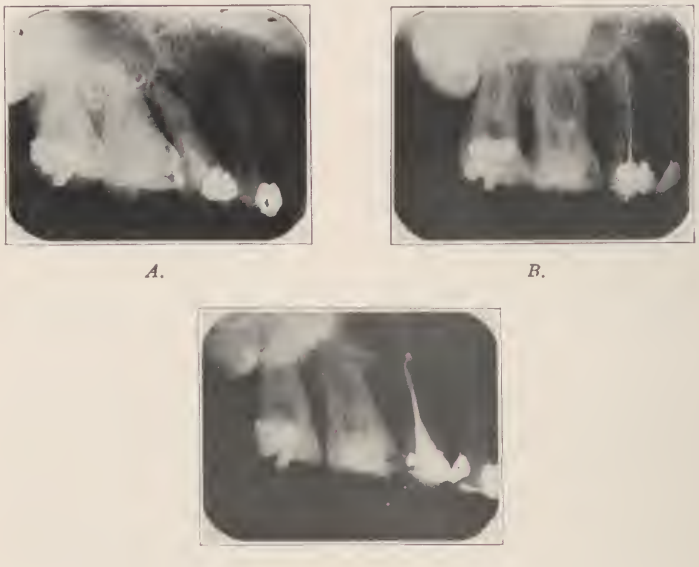
Fig. 247.—*A*. Upper right first premolar, partial root filling, periapical thickening due to chronic proliferative pericementitis. *B*. Same tooth, after opening and sterilization of canal, showing root filling extending slightly beyond apex.



A. *B.*

Fig. 248.—*A*. Lower right second premolar, partial root filling, periapical area of chronic rarefying osteitis with granuloma. *B*. Same tooth, after opening and sterilization of canal, showing root filling passing through apex into area of destroyed bone.

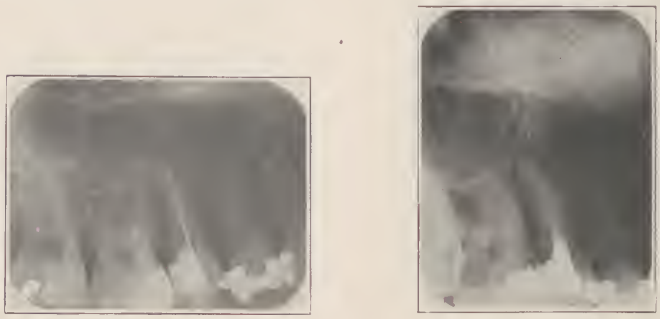
Illustrating the Use of the X-Ray as a Check on Root Canal Treatment



A. *B.*

C.

Fig. 249.—*A.* Upper left second premolar pulpless, partial root filling, periapical area of chronic rarefying osteitis with granuloma. *B.* Same tooth after opening and sterilization of canal, with diagnostic wires in place. *C.* Permanent root filling, passing slightly through apex.



A. *B.*

Fig. 250.—*A.* Upper left second premolar, showing two canals opened to apex with diagnostic wires in place. No periapical abnormality shown. *B.* Same tooth with both canals completely filled.

Illustrating the Use of the X-Ray as a Check on Root Canal Treatment

Fig. 251.

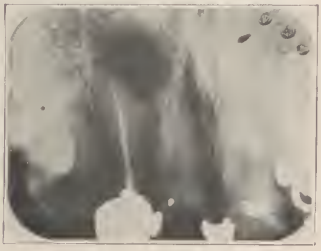
Fig. 252.

Fig. 253.

Fig. 251.—Upper right lateral incisor, root canal opened to apex, sterilized, and diagnostic wire in place.

Fig. 252.—Upper left central incisor, root filled. Filling passes through apical foramen and encapsulates apex.

Fig. 253.—Lower right second premolar; double curve of root, showing inability of diagnostic wire to negotiate curve and reach apex; peridental thickening about apex.



A.

B.

Fig. 254.—*A.* Upper left lateral incisor, clearly defined periapical area denoting cyst. *B.* Same case three months after opening and curettement of cyst cavity; bone regeneration taking place.

Illustrating the Use of the X-Ray as a Check on Surgical Treatment

A.

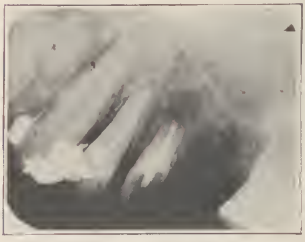
B.

C.

Fig 255.—*A*. Upper right premolar and molar region. Vital pulp in canine. First premolar crowned, apex projects into large area of chronic rarefying osteitis with clearly defined border, due to cyst formation, which apparently involves apices of canine and mesio-buccal root of first molar, though actually these teeth are not involved. Second premolar missing. *B*. Six months after extraction of first premolar and curettement of cyst cavity, showing bone regeneration. *C*. One year after operation, showing bone regeneration almost complete.

A.

B.



C.

Fig. 256.—*A*. Upper right second premolar, partial root filling, chronic abscess with discharging sinus. *B*. Taken immediately after complete root filling, apical resection and curettement. *C*. Nine months later, showing bone regeneration, and encapsulation of root end.

Illustrating the Use of the X-ray as a Check on Surgical Treatment

Fig. 257.

Fig. 257.—*(A)* Chronic rarefying osteitis with suppuration, root canal partially filled. *(B)* Showing case immediately after root amputation. *(C)* Case six months following the operation, showing filling in of the rarefied area with new bone. *(D)* Case twelve months after operation, showing complete recovery.

Views of Impacted Canines, No Attempt at Localization

Fig. 258.

Fig. 259.

Fig. 260.

Fig. 261.

Fig. 262.

Fig. 263.

Fig. 262.—Horizontal position of upper right impacted canine.
Fig. 263.—Unerupted impacted upper first molar, lying in horizontal position.

Localization of Impacted Canine

A. *B.*

Fig. 264.—Upper right impacted canine. In *A*, a more anterior view than *B*, the cusp of the canine overlaps the root of the central to a greater extent than it does in *B*, showing that the canine lies on the lingual or palatal aspect of the other teeth.

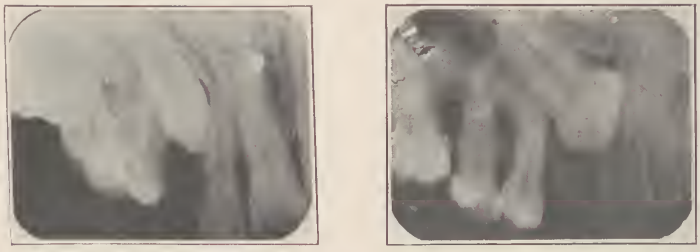
A. *B.*

Fig. 265.—Upper left impacted canine. In *A*, a more anterior view than *B*, the cusp of the canine overlaps the root of the central to a greater extent than it does in *B*, showing that the canine lies on the lingual or palatal aspect of the other teeth.

Localization of Impacted Canine

A. *B.*

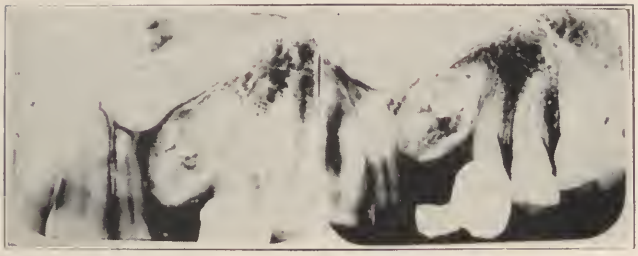
Fig. 266.—Upper left impacted canine. In *A*, a more anterior view than *B*, the cusp of the canine completely overlaps the root of the central incisor, while in *B* it only overlaps the root of the lateral, showing that the canine lies on the lingual or palatal aspect of the other teeth.



A. *B.*

Fig. 267.—Upper left impacted canine. In *A*, a more anterior view than *B*, the cusp of the canine only reaches the distal side of the root of the lateral incisor, while in *B* it partially overlaps the root of this tooth, showing that the canine lies on the labial aspect of the other teeth. A part of the temporary canine is seen in *B*.

Odontomes



A *B*

Fig. 268.

Fig. 269.

Fig. 270.

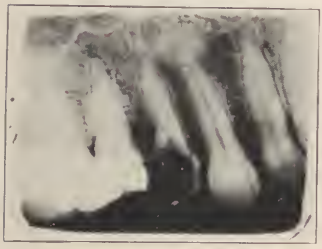


Fig. 271.

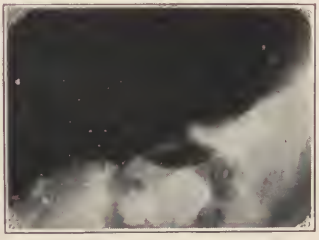


Fig. 272.

Fig. 268.—Composite odontome, in the region of the upper right canine. *(A)* Showing an impacted canine directly above a mass of small particles of enamel and dentine taking the shape of minute teeth; others irregular. *(B)* Same case taken from a different angle to get a better view of the odontome. (Courtesy Dr. John H. Gunter.)

Fig. 269.—Composite odontome, lying on the buccal side of the lower right first molar.

Fig. 270.—Composite odontome, region of the upper right third molar.

Fig. 271.—Radicular odontome, shown in the radiogram as a circular mass of dentine surrounding the apical region of the upper left canine. Radicular odontome being an aberration of the dentine and cementum.

Fig. 272.—Composite odontome, region of the lower left molars. Clinically giving the appearance of necrosis, but upon removal found to be a calcified mass consisting of cementum and dentine. This case is also shown in Fig. 317.

Anomalies

Fig. 273.

Fig. 274.

Fig. 273.—False gemination, being a fusion of two teeth by an excessive growth of cementum, occurring after development of the teeth.

Fig. 274.—True gemination, two teeth being fused together during development, having a common pulp chamber and root canal.

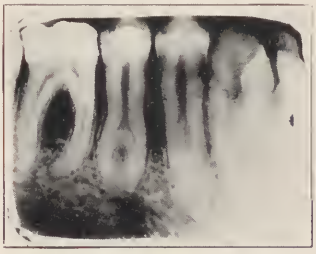


Fig. 275.

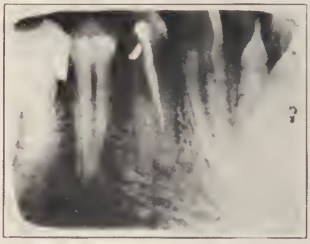


Fig. 276.

Fig. 275.—Showing a bifurcation of the root of the lower left second premolar at the apical third. Also a bifurcation of the root canal of the first premolar about the middle third of the root. The bifurcation of the second premolar being mesial and distal.

Fig. 276.—Bifurcation of the root of the lower left first premolar about the middle third of the root. The bifurcation being mesio-buccal distolingual.

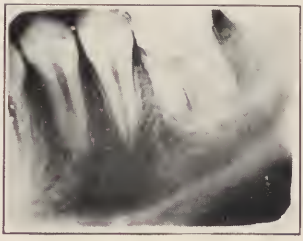


Fig. 277.

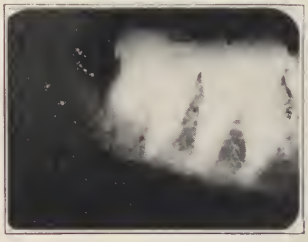


Fig. 278.

Fig. 277.—Showing a bifurcation of the root canal of the lower right first premolar. Bifurcation being mesio-distal.

Fig. 278.—Showing three-rooted lower left third molar.

Horizontal Impaction of Lower Molars

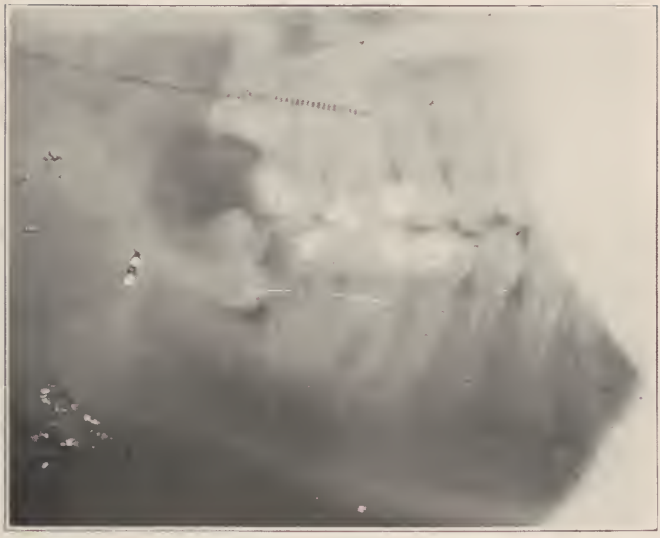


Fig. 279.—Horizontal impaction of the lower left third molar. Crown not covered by bone. Decay of crown of second molar, shown by dark area. Upper third molar unerupted, and lying slightly to one side of second molar.

Fig. 280.—Horizontal impaction of lower right third molar. Occlusal surface of crown is tightly in apposition with posterior surface of crown and root of second molar. Upper third molar partially erupted with occlusal surface of crown directed backward.

Fig. 281.—Horizontal impaction of lower left third molar.

Fig. 282.—Horizontal impaction of lower right third molar with decay of crown of second molar. Upper third molar unerupted. The light body shown above the premolar teeth is an unerupted third molar on the opposite side.

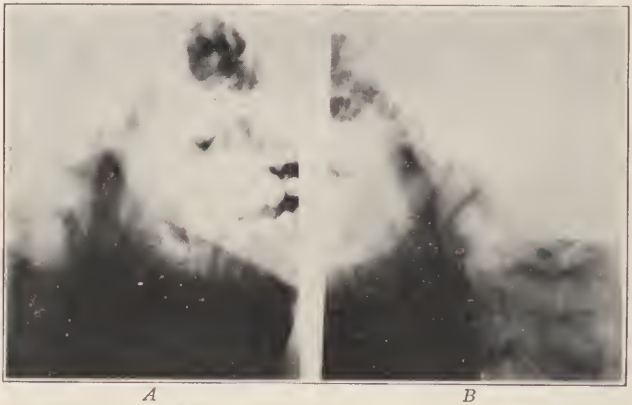
Fig. 283.—Oblique impaction of lower left third molar. Crown is largely covered by bone.

Fig. 284.—Impacted lower left third molar. Crown well erupted, and roots straight and spread apart. Dark area in crown indicates caries.

Fig. 285.—Impacted unerupted lower left third molar. Roots only partially developed. Unerupted upper third molar, apparently in good position.

Fig. 286.—Impacted unerupted lower premolar on the left side. This patient already had two premolars erupted and in good position on the left side, and three on the right side. In the upper jaw, the normal number of teeth were present

Fig. 287.—Supposedly edentulous patient 81 years of age. The arrow points to an unerupted canine with the crown directed forwards. Above is seen a film giving a better view of this tooth.



A *B*

Fig. 288.—(*A*) Impacted lower left third molar. (*B*) Lower right third molar. Both in a state of development.

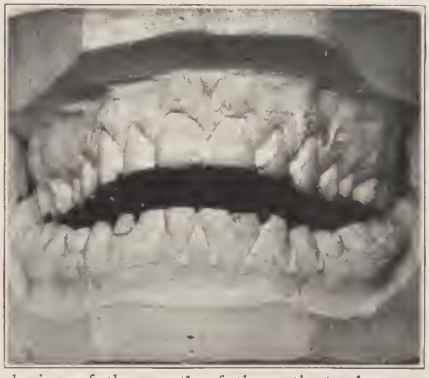


Fig. 289.—Frontal view of the mouth of the patient who one year previous had a normal occlusion.

Fig. 290.—Lateral view of the same case.

Note: Figs. 288, 289 and 290 are all of the same case. The malocclusion being due to the pressure exerted by the developing third molars upon the lower second molars. (Case of Dr. R. H. D. Swing.)

Fig. 291.—Lateral view of the mandible of child showing the normal development of the teeth.

Fig. 292.—Showing impacted lower left premolar lying in a horizontal position. Crown of the premolar lying against the root of the lower molar.

Fig. 293.—Showing impacted upper right first molar; the deciduous molar in position, showing partial absorption of the root.

Fig. 294.—Impacted lower left third molar lying in a horizontal position about ten millimeters distal to the second molar.

Cysts

Fig. 295.—Large area of bone destruction in left angle and ramus of mandible. Sharply defined outlines of this area make diagnosis of cyst probable. Patient gave history of having had abscessed condition and bone infection connected with third molar and operation many years before. At time roentgenogram was made, left side of face was swollen, there was difficulty in opening the mouth, and a small sinus was found on the upper aspect of the gum at the site of the lower third molar, through which a thin fluid discharged into the mouth. A diagnosis was made of dental cyst, probably originating from epithelial remnants around the third molar, left behind at the first operation. At operation, the thin bone overlying the cavity was rongeured away and the fluid contents and cyst wall removed. It was possible to pass a probe within the cavity almost up to the mandibular articulation, and down through a perforation into the neck. The diagnosis of cyst was confirmed by microscopic examination of the tissue removed, which showed a condition similar to that in Fig. 20.

Fig. 296.—Roentgenogram of same case taken four months later, showing almost complete obliteration of cyst cavity by regeneration of bone.

Cysts

Fig. 297.—Showing chronic rarefying osteitis with cyst formation in the region of the lower canine and premolars.

Fig. 298.—Chronic rarefying osteitis and cyst formation in the region of the lower right first molar, first molar having been extracted with no attempt of curettement.

Cysts

Fig. 299.—Chronic rarefying osteitis with cyst formation, region of the lower left premolar, lying just above the mental foramen.

Fig. 300.—Chronic rarefying osteitis with suppuration on the distal root of the lower left first molar. Chronic rarefying osteitis with cyst formation on the mesial root of the lower left first molar. Impacted lower left third molar lying in a horizontal position.

Cysts

Fig. 301.—Cyst, extending from the canine to the second molar region from the upper border of the mandible to within two or three millimeters of the lower border of the mandible. The canine and molar teeth having been crowned and fastened together with strong rigid bar to prevent fracture upon removal of the cyst.

Fig. 302.—Infected cyst, region of the lower left first premolar extending back to the second premolar, second premolar having been extracted some time previous.

Cysts

Fig. 303.—Multilocular cyst, region of the angle of the right mandible. Several cyst cavities of various sizes lying between the internal and external alveolar plates which have become much attenuated and enlarged.

Fig. 304.—Bone cyst of mandible, not dependent on dental epithelium. Cavity in bone contained granulation tissue and disintegrating bone particles, no epithelial lining.

Cysts

A. *B.*

Fig. 305.—*A*. Cyst of right side of upper jaw, arising in connection with small piece of root of first molar. The cyst extended upward encroaching upon the cavity of the maxillary sinus, but not communicating with it. *B*. Film showing more details of cyst. Light area in upper right corner is the shadow cast by the malar bone.

Fig. 306.—Follicular or dentigerous cyst, region of the lower left third molar. It contains a glairy fluid with cholesterin crystals and broken-down epithelial cells in suspension and a fully or partially developed tooth or teeth lying in its interior. The cyst extends from the distal border of the ascending ramus to the region of the first premolar and allowing only a very thin plate of bone to remain on the lower border of the mandible.

Cysts

Fig. 307.—Large area of bone destruction on right side of mandible due to cyst formation probably arising in connection with irritation following periapical infection about the second premolar and first molar. Observe sharp outline of cavity.

Fig. 308.—Large infected cyst of right side of mandible due to infection about roots of first molar, which had been lost some time previously.

Osteomyelitis

Fig. 309.—Right side, showing extensive bone destruction of lower jaw due to acute osteomyelitis. The infection started two weeks previously in connection with the second molar. The condition involved the lower jaw from angle to angle, all of the teeth being extruded. (Case of Dr. A. J. Kuhnmuench.)

Fig. 310.—Osteomyelitis, mandible of a child about eight years of age, starting from the lower right first molar. It extends from the angle of the ramus to the symphysis.

Osteomyelitis

Fig. 311. -Composite odontome, with osteomyelitis, lower left mandible, extending from the ramus to the symphysis.

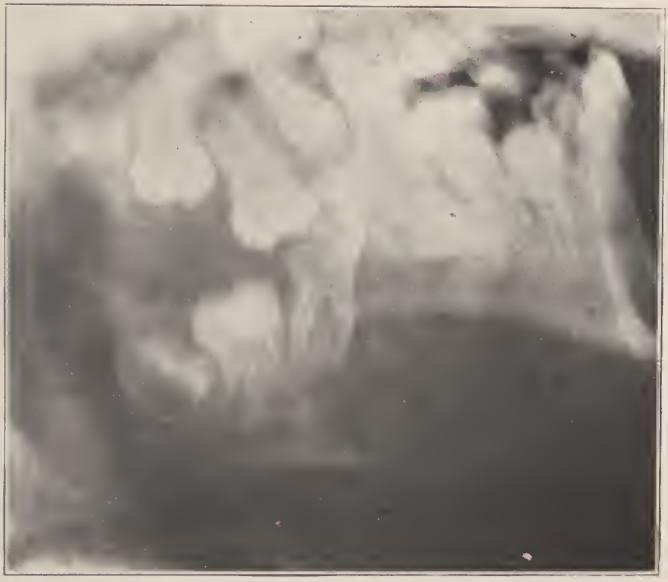


Fig. 312.—Spindle cell sarcoma, lower left mandible of a child about eleven years old, extending from the second molar to the region of the canine. Fusiform expansion of outer and inner cortical plates.

Odontomas

Fig. 313.

Fig. 314.

Fig. 313.—Calcified composite odontoma of right side of mandible in an adult. Patient for several years had had several sinuses discharging on the skin at the lower border of the jaw. In the mouth, the teeth were absent, but pus discharged through several sinuses at the bottom of which hard substance could be felt with a probe. X-ray shows several irregular masses, denser than bone, in places resembling tooth structure.

Fig. 314.—Calcified composite odontoma of lower jaw resembling in history and clinical signs the preceding case.

Fig. 315.—Calcified composite odontoma in a boy ten years of age. Symptoms began with inflammatory swelling of lower jaw, pus finally pointing externally and drained by incision near angle of jaw. A diagnosis of osteomyelitis was made. Swelling and pus discharge were still present when first seen by author two weeks after incision. No molar teeth erupted, and no history of ever being present. X-ray shows unerupted first molar near lower border of jaw. Behind and above this is seen a dense irregular mass, in places showing outlines of parts of teeth, extending well back into ramus of jaw. Operation consisted in removing the mass and the unerupted tooth from within the mouth. Tumor weighed 1½ oz.

Odontomas

Fig. 316.—Composite odontoma, lying in the region of the lower left third molar. The molar had been extracted; patient was suffering intense pain.

Fig. 317.

Fig. 318.

Fig. 317.—Composite odontoma, region of the lower left molar. On clinical examination there was an opening into the mouth through the mucous membrane and upon insertion of a probe a dense mass similar to a tooth, could be felt.

Fig. 318.—Extracapsular odontoma, lying in the canine region of the lower left mandible, having the appearance of an impacted canine with a calcified cauliflower shaped mass attached to the enamel of the impacted tooth. The calcified mass is obviously the dental capsule which had undergone a retrogressive metamorphosis.

Fig. 319.—Periapical bone destruction connected with lower left second molar. Patient, fourteen years of age, had lost first molar on that side some years previously. For several months had had a sinus discharging through the skin just below the lower border of the mandible. The second molar appeared normal except for a large filling. On extraction of this tooth a dead infected pulp was found.

The crowns of the unerupted upper and lower third molars with undeveloped roots are shown. Upper third molar of opposite side is seen as a light area above the premolar region.

Fig. 320.—Retained piece of root of lower left first molar, which gave rise to chronic sinus with purulent discharge beneath jaw, extending over a period of years.

Fig. 321.—Root of upper right first molar lost in maxillary sinus during attempted extraction. A plate should always be made in a case of this kind, the two sides of the face being made to overlap as much as possible, so that the maxillary sinus will not be obscured by the bone of the opposite side.

Fig. 322.—Root of upper right first molar lost in maxillary sinus during attempted extraction.

Fig. 323.—Roentgenogram of right side, showing lack of development of both premolars and third molar in upper jaw and second premolar and third molar in lower jaw. Patient gave history of never having erupted upper first and second premolars and lower second premolar on either side. Referred by Dr. Carl B. Case for roentgenographic examination.

Fig. 324.—Same case, showing similar condition on left side.

Fractures

Fig. 325.—Fracture of left side of mandible just in front of second molar. First molar missing. The line of fracture in this region is nearly always oblique, running from above downward and backward.

Fig. 326.—Fracture of left side of mandible in second premolar region. The root of this tooth is found in the line of fracture, and will probably require extraction before union can occur.

Fractures

Fig. 327.—Fracture of left side of mandible near canine tooth, with very few teeth present. This is said to be the commonest site for fracture to occur.

Fig. 328.—Fracture through neck of condyle of mandible. The lower end of the small fragment in these cases is generally pulled forward by the external pterygoid muscle. The ramus of the jaw is displaced externally to the smaller fragment, causing the lower teeth to be drawn over toward the affected side.

Fractures

Fig. 329.—Double fracture of mandible in molar region on each side. Attempted fixation by means of Lane's plates. The plates had to be removed after two weeks owing to infection and nonunion.

Fig. 330.—Same case, showing swaged metal intermaxillary splint in position.

Fractures

Fig. 331.—Fracture of the mandible in the region of the lower left premolars, being in the nature of a green stick fracture, there being no displacement.

Fig. 332.—Fracture of the lower right mandible, extending from the lower right lateral downward and backward to the lower border of the mandible beneath the second premolar; the root of the canine also being fractured.

Fractures

Fig. 333.—Compound fracture of the mandible of the left side in the premolar region, showing an extensive displacement.

Fig. 334.—Fracture in the lower right mandible in the region of the canine, showing considerable displacement. The dense area in the body of the mandible along the lower border near the angle was caused by a dirty intensifying screen, hypo being allowed to drop thereon.

Fractures

Fig. 335.—Fracture of the mandible between the second and third molars, showing a sequestrum in the line of fracture.

Fig. 336.—Fracture of the left mandible distal to the lower third molar.

Fractures

Fig. 337.—Double line of fracture, left mandible between the second and third molars.

Fig. 338.—Fracture of the left mandible, region of the third molar showing a slight displacement.

Fractures

Fig. 339.—Fracture of the left mandible, region of the lower third molar. Fracture anterior to the third molar running downward and backward with some displacement. Case has been wired.

Fig. 340.—Fracture of the right mandible, extending from the lower right canine downward and backward across the body of the mandible to the angle.

Fractures

Fig. 341.—Double line of fracture running horizontally through the body of the right mandible; impacted lower right second premolar in the body of the mandible, the apex being in the line of fracture.

Fig. 342.—Fracture of the ascending ramus posterior to the right third molar; there is slight displacement.

Fractures

Fig. 343.—Fracture of the coronoid process of the ramus of the right side.

Fig. 344.—Fracture of the condyloid process of the left side. Displacement marked.

Fractures

Fig. 345.—Fracture of the upper border of the mandible on the left side in the molar region, caused in extraction of the third molar. The fragment lies above the border of the mandible.

Necrosis

Fig. 346.—Necrosis of the mandible on the left side in the molar region. The sequestrum above the upper border of the mandible.

Necrosis

Fig. 347.—Necrosis of the left mandible, region of the molars, showing two distinct sequestra.

Fig. 348.—Necrosis of the left mandible, extending from the canine to the third molar region.

Fig. 349.—Osteoma, molar region of the right mandible, extending above the border of the mandible and down the buccal side about eight millimeters.

Fig. 350.—Empyema of the left maxillary sinus, shown again as a light shadow compared with the right maxillary sinus which is dark or normal. Fig. 350 was taken at a different angle from Fig. 351, as in Fig. 351 we have frontal sinus shown, while in Fig. 350 more attention is paid to the mandible and maxilla with the maxillary sinus.

Fig. 351.—Empyema of the maxillary sinus, left side, showing a marked definition in shadows compared with the right side.

Fig. 352.

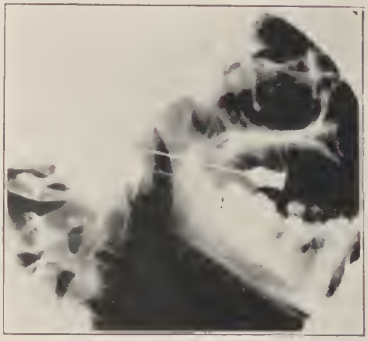


Fig. 353.

Fig. 352 and Fig. 353.—Showing the method used in localizing a broken needle. A 22-gauge needle is injected in the proper position and the patient x-rayed. Fig. 352 taken in the anterior-posterior position showing whether the broken needle is nearer the median line or nearer the ramus. Fig. 353 is the lateral view, showing whether the broken needle is above or below the one last injected and how far distal the broken needle lies.

Fig. 354.—Lateral view, showing broken needle lying above the localizing needle.

Fig. 355.—Anteroposterior view of Fig. 354, the broken needle lying mesially to localizing needle.

Large Horizontal Films

Fig. 356.

Fig. 357.

Fig. 356.—Showing chronic rarefying osteitis with suppuration, region of the upper left lateral.

Fig. 357.—Chronic rarefying osteitis with cyst formation, the cyst extending from the upper left central distally to the upper left second premolar. First premolar missing. Upper left lateral crowned, and the upper left canine being non-vital tooth.

Fig. 358.

Fig. 359.

Fig. 358.—Dental root cyst, region of the upper right lateral and canine, probably due to a deciduous tooth. The dark area over the root of the upper right molar is the shadow of the maxillary sinus.

Fig. 359.—Dental root cyst, the cystic area lying between the roots of the upper right canine and the right central, the lateral incisor is missing.

Fig. 360.

Fig. 361.

Fig. 360.—Dental root cyst, region of the upper right central and lateral incisors. Cyst being about 15 mm. in width and 25 mm. in length.

Fig. 361.—Dental root cyst, region of the upper right canine and lateral, cystic area being about 25 mm. in diameter.

Fig. 362.

Fig. 363.

Fig. 362.—Dental root cyst, cystic area being about 35 mm. in width and 45 mm. in length, in region of the upper right canine and lateral. The right lateral crowned, also the upper right second premolar. The first premolar is missing, and probably is the direct cause of the cyst.

Fig. 363.—Dental root cyst, region of the upper left lateral. Upper left central missing. Cyst is about 50 mm. in length and 30 mm. in width. Upon operation it was found that the upper wall extended up through the sinuses to the base of the brain and was malignant. Patient suffering from blindness, with history of loss of sight coming on gradually.

Fig. 364.

Fig. 365.

Fig. 364.—Dental root cyst, region of the upper central and lateral about 35 mm. in width and 30 mm. in length, showing an impacted canine tooth lying in the cyst. Patient was seven years of age.

Fig. 365.—Dental root cyst, region of the upper left lateral, cyst being about 35 mm. in width and 20 mm. in length. Patient was wearing an upper plate over the roots of the upper right lateral and first premolar, which had been ground to the gingival margin.

Fig. 366.

Fig. 367.

Fig. 366.—Dental root cyst, region of the upper left third molar. Cyst about 40 mm. in length and 20 mm. in width. Radiogram also shows deciduous canine lying between permanent canine and the first premolar.

Fig. 367.—Dental root cyst, region of the upper left premolars. The cyst being 25 mm. in length and 15 mm. in width. The first and second premolars are missing. The upper left central and canine have artificial crowns and incomplete root canal fillings.

Fig. 368.

Fig. 369.

Fig. 368.—Multilocular cyst, region of the lower left canine, the cystic area being about 50 mm. in length and about 25 mm. in width. Radiogram also shows large calculus lying in Wharton's duct, shown in the radiogram as a light shadow in the floor of the mouth, lingual to the molar region.

Fig. 369.—Impacted lower left canine, lying along the lower left border of the mandible, root not fully calcified, with deciduous canine in position and the two premolar teeth in a state of development. Roots not fully calcified.

Fig. 370.

Fig. 371.

Fig. 370.—Chronic rarefying osteitis with cyst formation, region of the lower central incisors. Cystic area being about 10 mm. in diameter. Radiogram shows chronic proliferative pericementitis in the apical region of the lower left lateral and central incisors.

Fig. 371.—Chronic rarefying osteitis with cyst formation, lower anterior region. Cystic area being about 15 mm. in diameter. The dark area in the region of the apex of the lower right central is due to a fistula having been established.

Fig. 372.

Fig. 373.

Fig. 372.—Spindle cell sarcoma, region of the symphysis of the mandible. Patient twelve years old.

Fig. 373.—Showing the same case as Fig. 372, one year after the operation, there being a recurrence of the growth.

Fig. 374.

Fig. 375.

Fig. 374.—Carcinoma of the left maxilla, region of the second premolar, showing loss of bony tissue.

Fig. 375.—Calculus lying in Wharton's duct, shown in the radiogram as a light shadow in the submaxillary region, lingual to the mandible.

Fig. 376.

Fig. 377.

Fig. 376.—Supernumerary tooth, lying in the median line of the palate, crown pointing posteriorly and the root not fully developed.

Fig. 377.—Supernumerary tooth, lying in the median line of the palate, crown pointing posteriorly, root partially developed and lying over the anterior palatine foramen.

Fig. 378.

Fig. 379.

Fig. 378.—Showing two supernumerary teeth, lying in the palate just posteriorly to the central incisors.

Fig. 379.—Being the same case as Fig. 378, but taken from the opposite side, again showing two supernumerary teeth in line with each other, the crowns pointing distally and the roots not fully developed.

Fig. 380.

Fig. 381.

Fig. 380.—Two supernumerary teeth, lying distally to the permanent central incisors and fully erupted. Also a supernumerary tooth lying in the region of the upper right first molar.

Fig. 381.—Supernumerary tooth lying in the region of the upper left central incisor, preventing its eruption.

Fig. 382.

Fig. 383.

Fig. 382.—Supernumerary tooth, lying lingually to the upper left central incisor. The upper right canine is impacted, with the deciduous canine in position.

Fig. 383.—Supernumerary tooth, lying in the median line, erupted and directly between the upper right and left central incisors. Large pulp stone in the upper left central incisor.

Fig. 384.

Fig. 385.

Fig. 384.—Chronic suppurative pericementitis, involving all of the erupted teeth in the maxilla, with two impacted canines coming to a point in the median line.

Fig. 385.—Two impacted canines, lying in the palate on either side of the median line.

Fig. 386.

Fig. 387.

Fig. 386.—Impacted upper left canine, lying in the oblique position, crown pressing against the root of the lateral incisor. The deciduous canine in position with a slight resorption in the root.

Fig. 387.—Impacted upper left second premolar, lying on the lingual side of the arch, directly above the canine and first premolar.

Fig. 388.

Fig. 389.

Fig. 388.—Impacted upper left canine, lying in a horizontal position under a bridge on the palatal side of the arch. Chronic rarefying osteitis with cyst formation, apical region of the upper left premolar, which is used as a bridge abutment.

Fig. 389.—Upper right central incisor, mal-formed, crown erupting at an angle of 45 degrees with the median line. The two lateral incisors in position, but not fully erupted and the roots not fully calcified.

Fig. 390.

Fig. 391.

Fig. 390.—Impacted upper left canine, lying in a horizontal position, on the palatal side of the arch. The deciduous canine in position, showing a resorption of the root.

Fig. 391.—Impacted upper right canine, in a supposedly edentulous mouth. Also a fragment of root lying in the left central incisor region.

Fig. 392.

Fig. 393.

Fig. 392.—Lingual root, upper left first molar which was pushed into the maxillary sinus during extraction, now lying above the root of the upper left molar.

Fig. 393.—Root of the upper right second premolar, which was pushed into the maxillary sinus during extraction, now lying over the lingual root of the first molar.

Fig. 394.

Fig. 395.

Fig. 394.—Chronic suppurative pericementitis, showing loss of the alveolar process around the roots of the upper left central and lateral incisors.

Fig. 395.—Chronic suppurative pericementitis, showing a complete loss of the alveolar process around the roots of the upper right lateral canine and first premolars.

Note: Figs. 394 and 395 are radiograms of the same case.

Fig. 396.

Fig. 397.

Fig. 396.—Showing an oblique fracture of the mandible on the right side from the premolar to the molar region.

Fig. 397.—Fracture of the mandible in the region of the left lateral, left lateral and canine being in the line of fracture.

Fig. 398.

Fig. 399.

Fig. 398.—Bony growth extending back in the floor of the mouth from the symphysis, following a comminuted fracture of the mandible.

Fig. 399.—Fracture, region of the lower central incisors showing some displacement.

Fig. 400.

Fig. 401.

Fig. 400.—Hypercementosis of the roots of the upper right canine, and the first and second premolars.

Fig. 401.—Necrosis in the upper right canine region, showing a decided roughening of the border of the alveolar process.

Fig. 402.

Fig. 403.

Fig. 402.—Maxillary sinus, extending from the upper left lateral region to the region of the upper third molar. Care should be taken in diagnosis not to mistake for cyst.

Fig. 403.—Chronic rarefying osteitis with suppuration, apical region of the upper left central incisor, which is being used as a bridge abutment.

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